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THE GEOGRAPHICAL JOURNAL

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The Geographical Journal

Vol. LXIX No. 6 June 1927

SOME CONTRASTS IN NIGERIA

The Rt. Hon. W. G. A. Ormsby-Gore, M.P.

Read at the Meeting of the Society, 7 March 1927.

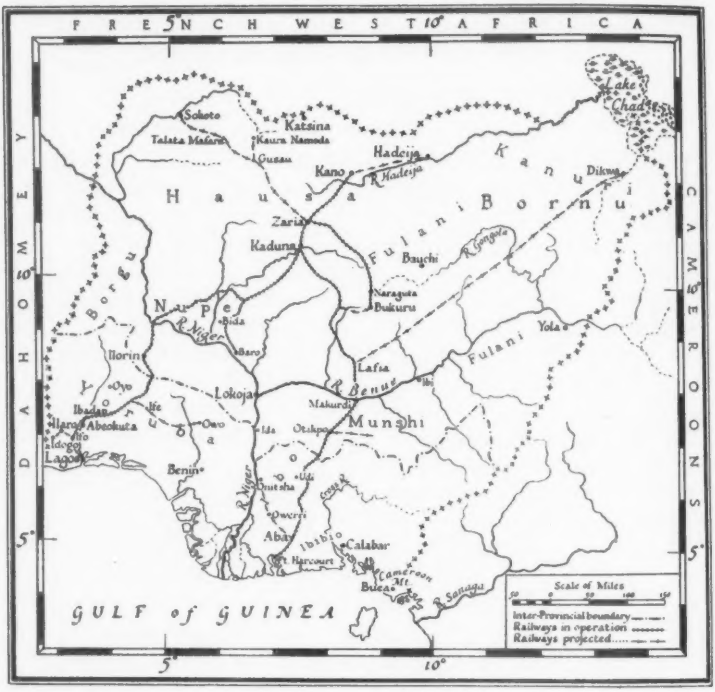
EARLY last year I spent some six weeks in Nigeria; a fortnight was taken up by conferences in Lagos, and a month by a hasty tour throughout the country. This tour included visits to the following places: Abeokuta, Ibadan, Oyo, Ilorin, and Benin in the south-west; Onitsha, Owerri, Port Harcourt, Calabar, Udi, and Makurdi in the south-east; the Bauchi plateau, Kano, Katsina, Sokoto, Zaria, and Kaduna in the north. So rapidly did I cover the ground that I fear any observations must necessarily be superficial. I have endeavoured to check my statements wherever possible by reference to two recently published works on Nigeria, which are clearly of the utmost value. These are, first, the two-volume book on 'The Northern Tribes of Nigeria,' by C. K. Meek, published by the Oxford University Press in 1925; and second, 'The Peoples of Southern Nigeria,' in four volumes, by P. A. Talbot, published by the Oxford University Press in 1926.

Nigeria is a very large country, rather more than seven times the size of England. It is the most populous of all British dependencies other than India, containing as it does approximately 20 million people. Of this 20 million there are between 4000 and 5000 Europeans, none of them permanently resident in the country, a few hundred Syrians who engage in trade, and the whole of the rest are Africans of the most varied description.

The first and most obvious contrast in Nigeria is that between the comparatively narrow southern belt, subject to extremely high rainfall widely distributed throughout the year and consequent excessive humidity, as against the much larger area to the north which is, generally speaking, hot and dry, with an average rainfall of between 20 and 60 inches confined to a clearly marked wet season in the summer months. This climatic line between these two contrasted areas runs slightly to the south of the line which separates administratively the provinces grouped under the Lieutenant-Governors of the Northern and Southern Provinces respectively. The reason for the existing political boundary between the

two groups of Provinces is mainly historic. Prior to 1900 there was the Colony of Lagos and Protectorate of Southern Nigeria, while all the country to the north was that over which the Niger Company had or claimed various rights. This division has continued, but it is not a natural boundary, either physical, climatic, or ethnographic.

The southern belt is uniformly low-lying except at its eastern extremity, along the Cameroons border. It is a country densely clad in natural forest, the most distinguishing feature of which is the prevalence of the



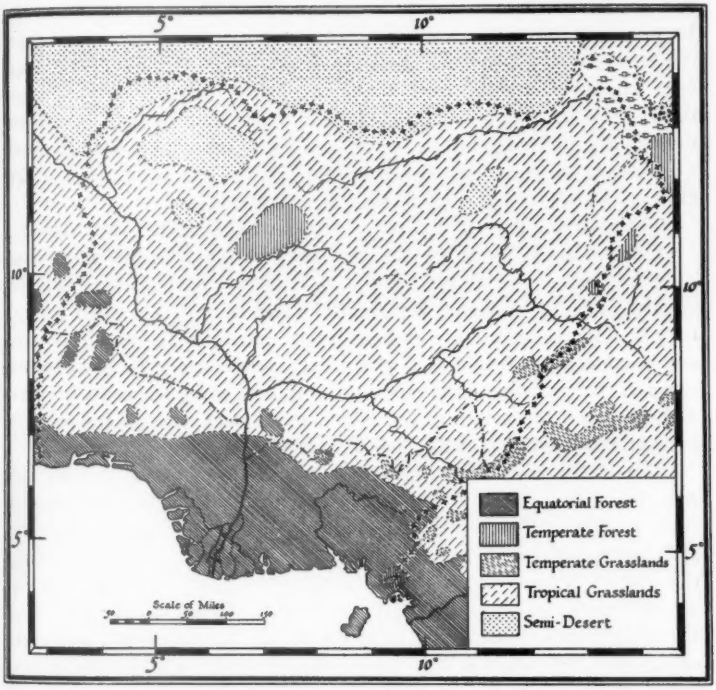
Sketch-map of Nigeria

oil palm that still constitutes the principal source of wealth and commerce of the whole country.

The larger northern area is for the most part also low-lying, though its general elevation is perceptibly higher than that of the Southern Provinces. In the centre there is the so-called Bauchi plateau, an open and practically treeless country running up to a maximum elevation of about 4000 feet. In the north-west there is higher country round Kaduna running up to an elevation of 2500 feet, where the rainfall is greater than elsewhere in the Northern Provinces, and where the country is for the most part clad by fairly dense bush, including trees up to 30 or 40 feet

in height. Much of Northern Nigeria is either open country or covered with low scrub. The main causes of the differentiation between the natural vegetation of north and south would seem to be the varying quantities and distribution of rainfall.

Man has necessarily been affected in his character and habits by the contrasted environment so produced, but it would seem that the main contrasts which are obvious to any casual visitor to Nigeria are the result not so much of these climatic contrasts as of man himself. The main



The Vegetation of Nigeria

contrasts are the contrasts brought about by different racial types and civilizations, and it is with these that I wish to deal more particularly.

I am conscious that I shall have to paint the picture with an extremely broad brush, and that such treatment necessarily conflicts with scientific accuracy in detail. Practically everything which I shall say, therefore, will have to be qualified by the words " broadly speaking."

The first contrast apparent in my tour was the very marked one between south-western Nigeria and south-eastern Nigeria, the river Niger being roughly the dividing line.

The Southern Provinces contain approximately 9 million people.

All are negroes, the immense majority of whom are pagans, with a fair-sized Christian minority. Very few are Muhammadans. The use of the word "pagan" is, of course, unscientific, and covers a great variety of indigenous African religions, most of which, if not all, can be better described as animist.

South-western Nigeria may be described as Yorubaland, though the people of Benin who are included in this area are usually called Edos. The Edos are very similar to the Yorubas, who dominate throughout the rest of the area. The Yorubas and their kinsmen the Edos are Sudanic negroes. They almost certainly migrated to Nigeria some time during the early part of the first millennium before Christ. They came from the north-east and were, from the time of their first arrival, users of iron. When they came their arts and agriculture seem to have been dominantly affected by ancient Egypt. Their first capital was Ife, and Ife remains to-day the principal religious centre of Yorubaland. The evidence for these statements is set out in Talbot's book.

The political derivatives from Ife were in the main two, namely, Oyo and Benin. The monarchical dynasty of Oyo, formerly paramount over the greater part of the hinterland, is of very ancient date, and the Alafin of Oyo is still the biggest chief of Yorubaland. The other derivative, Benin, appears to have broken away round about the year 1000 A.D. and became, at the height of its power in the beginning of the seventeenth century, the principal if not the sole authority along the coast between Dahomey and the mouth of the Niger, paramount over all the country between the dominions of the Alafin of Oyo and the sea.

The highly organized and complex Yoruba states are among the most interesting examples of negro civilization. They have undergone comparatively little change in type throughout the centuries, and the glimpses we get of them from the early European travellers following the first Portuguese arrivals in the second half of the fifteenth century are still visible to-day. In 1601 a Dutchman named de Bry described the straight streets of the city of Benin and the houses standing in good order. In 1668 another Dutchman, Dapper, who also visited Benin, stated that the town had thirty quite straight streets about 120 feet wide, with well-built houses in good order, decorated with gables. The King's compound he described as as big as the town of Haarlem, containing large square courts surrounded by galleries as big as the Exchange of Amsterdam. He noted the metalwork, especially the copper reliefs depicting deeds of battle. The city of Benin is still surrounded by the wall and deep ditch, some 9 miles in circumference, and formerly had a very much larger population than it possesses to-day. The houses are still well built, in good order, the streets wide, and the courts of the King's compound are as described 250 years ago.

The great towns of Yorubaland seem always to have been characteristic, and there are to-day no less than nine cities in Yorubaland (Benin

Phot. C. Rhys

The Alafin of Oyo

Phot. C. Rhys

Yorubas at Oyo

Phot. C. Rhys

Hausa Horsemen

Phot. C. H. Foulkes

The Lower Niger

is not one of them) that have more than 40,000 inhabitants. One of them, Ibadan, is a native-built city with nearly a quarter of a million inhabitants. One of the remarkable features of Yorubaland is the fact that the bulk of these town dwellers are agriculturists who live in the town but farm holdings often situated at a distance of some miles from their homes.

From an early date, therefore, the Yorubas have had a large urbanized population, skilled not only in agriculture but in many arts and crafts, such as stone carving, metalwork, building, and weaving; but their outstanding characteristic has been their theocratic monarchies. Fundamentally the Yoruba religion is really the worship of the apotheosized heroes of the original migration. Shango, the principal warrior in that event, has become the Lightning God. But important though these religious beliefs are, they are somewhat overshadowed by the sacred and almost deified position that they give to their great chiefs. This gives to the chiefs a spiritual as well as a political and judicial authority over their people which it is hard to overestimate. This spiritual authority possessed by the ruling chiefs, the Alafin of Oyo, the Oni of Ife, and the Oba of Benin, is intimately bound up with the supreme importance of ancestor worship. It would seem that the dominating idea is the influence for good or evil over the whole people of the spirit of a deceased paramount chief, and the position of the Oba of Benin has for centuries been what it has owing to his unique relation to the almost all-powerful spirit of his predecessor.

The chief characteristic in Yorubaland of the worship of gods or deceased spirits is sacrifice, the offering of food and lives, and throughout Yorubaland human sacrifice in the past has been an all too prevalent feature of this worship. It would seem, too, that in Yorubaland, as in ancient Egypt, kingship has possessed a unique significance. Not only are sacrifices, including human sacrifices, paid to the spirit of the deceased king, but there were buried with him wives, slaves, children, and all the articles of daily life and work which his spirit would require in the spirit world, conceived very much as a continuance of life in the present world. Cannibalism, however, seems never to have been known among the Yorubas.

Deriving from religious ideas connected with the position of the chief, the Yorubas have been able to evolve an effective centralized machinery of government over large areas. The autocratic power of the chief when alive was always mitigated by the hierarchy of nobles and functionaries, each with their well-established customary rights. The basis of their society, whether in the supreme office or minor offices, is hereditary, and the basis of property seems always to have been hereditary in the male line.

The Yorubas have always been mainly an agricultural people, and practically all the agricultural work has been done by the men and not

the women. This fact seems to be one of the contrasts between the custom of the Sudanic negroes and that of the Bantu or so-called semi-Bantu, of whom more anon.

The main staple food of Yorubaland is the yam, a large starchy tuber developing on a vine. Yams, together with peppers, palm oil, and fish, form the main basis of subsistence, while game is hunted and eaten; but for many years past, owing to the tsetse fly, it would appear that the number of domestic animals—a few small black goats—in the towns and villages have been few and far between. That this was not always the case it may be noted in passing, for we have a record of the year 1601 that the Oba of Benin had a considerable quantity of cavalry, which would seem to point either to the absence of tsetse fly or to its non-infection at that date. To-day no horse can live in Benin.

The Yorubas built their houses entirely of solid mud without the aid of a stick framework. They were always rectangular in shape and similar in lay-out to that of ancient Egypt. The most representative collection of the arts of the people of south-western Nigeria is the collection of Benin bronzes and sculpture in the British Museum.

On crossing the Niger we find, to quote the words of Talbot, "the population is composed of peoples living in independent, unconsolidated, and usually small groups, subject to no central government." In south-eastern Nigeria, which is far more densely populated than south-western Nigeria, we have immediately along the left bank of the Niger a very numerous people (over 3 millions) called the Ibos. The Ibos, like the Yorubas, speak a Sudanic language, but beyond this fact and their universal cultivation of the yam, they are singularly different from the Yorubas. The Ibo is smaller and more backward in every way than his western neighbour. There is none of the aristocratic or theocratic social organization. They are less skilful as traders or craftsmen, slower to adapt themselves to new ideas. It is remarkable to see the activity of the new Yoruba colony springing up at Port Harcourt in contrast to the more primitive and less progressive Ibos of the district.

East again of the Ibos in the provinces of Calabar, Ogoja, and Munshi, we enter another new world where the inhabitants consist of a number of different tribes known collectively as semi-Bantu. I always think the word "semi-Bantu" is most misleading. It would suggest a people whose language is half Bantu and half something else. It is, of course, nothing of the kind. The better word would be "proto-Bantu," as probably the more correct notion is that the Bantu languages of East and South Africa contain and have evolved from roots which are discoverable in the more primitive so-called semi-Bantu languages. "Semi-Bantu" would seem more applicable to the language of a tribe like the Nagumi who inhabit the Benue valley, 42 per cent. of whose words are Bantu and 53 per cent. Sudanic.

The peoples of the eastern part of Southern Nigeria, and the pagans

of the Bauchi plateau in Northern Nigeria, are collectively all classed as semi-Bantu. They are almost certainly the relics of the original indigenous inhabitants of Nigeria before the immigration of the Sudanic peoples, and of the others who followed them, of whom I shall speak in connection with the Northern Provinces.

One of the chief characteristics of all these proto-Bantus, whether in Northern or Southern Nigeria, is their addiction to cannibalism. Cannibalism is practically unknown among the Sudanic tribes.

It is perhaps unfortunate that the most numerous of proto-Bantu tribes in south-eastern Nigeria should be called the Ibibios, which to the layman sounds all too like Ibos, the name of their neighbours. A traveller to Calabar in 1789 would seem to have got hold of a better orthography. He wrote, "The Ibbibby are much disliked by the Heebo, and are called by them cannibals. They (the Ibbibby) file their teeth so as to look like a saw, and they are always the ringleaders of any mutiny on board ship."

I said just now that these people may be the aboriginal possessors of the country—they are certainly very much lower in civilization. On the Bauchi plateau they are still for the most part naked, and among the proto-Bantus in south-eastern Nigeria the introduction of clothing has for the most part only followed contact with European commerce.

There are in south-eastern Nigeria, in the Cross river basin, the remains of stone circles, menhirs, and even, it is alleged, dolmens, which show that at one time the great heliolithic culture which we in England associate with Stonehenge once obtained in south-eastern Nigeria. I know of no photographs of these monuments, and only a few of them seem to have been seen by Talbot. Their further investigation should prove of great interest.

These stone remains are still of course regarded with superstitious reverence by the local natives, but it is doubtful whether they have any remnant of the characteristics of the heliolithic culture or any valuable traditions concerning the origin of the monuments. They certainly have no knowledge of its arts and crafts or of the working of stone.

The bulk of the proto-Bantu tribes of Northern and Southern Nigeria build round houses as opposed to the rectangular houses of the Sudanic negroes. The Ibibios, however, have evidently learnt the rectangular form of construction from their Ibo neighbours, but in contrast to the Yorubas the Ibibios build their houses by plastering mud on a stick and leaf framework, a practice dispensed with by the Yorubas.

There are no towns in south-eastern Nigeria except those that have sprung up on the coast, as the result of the coming of Europeans. East of the Niger both Sudanic negroes and proto-Bantus live in small villages, seldom more than a few families together, the site of which is continuously moved with the shifting cultivation that is practised.

Among the proto-Bantus men clear the forest by cutting and burning

the trees, and the women do the agricultural work. It is doubtful whether at any time before the coming of the British they had any cohesion whatever. Efforts are, however, now being made to endeavour to ascertain whether there is any tradition of a clan organization superior to the individual village, and in some cases—but these are so far few—it has been possible to identify a claim of descent from a common traditional ancestor. But in many cases even this is lost. In this area, therefore, the creation of any system of native administration at all comparable to that operating in the highly organized Yoruba states or in Northern Nigeria is an extremely difficult task.

The religion of the proto-Bantus of south-eastern Nigeria would seem generally to include the worship of the supreme male god of the sky and his inferior consort the earth goddess, coupled with the cult of earth and particularly water spirits. To spirits are attributed the fertility or non-fertility of man, animals, and crops. The propitiation of these spirits by offerings seems to be general. The chiefs have little or no spiritual authority. Priestesses of local cults are a feature. Ancestor worship on animist lines is general, but has few of the characteristics of the special importance of the spirits of deceased chiefs so noticeable in Yorubaland.

Before leaving Southern Nigeria I should mention that the Portuguese introduced, mainly from the New World, new economic products which supplemented the original universal native foods of yam, pepper, palm oil, and fish. The principal things introduced by the Portuguese were cassava, maize, oranges, pawpaw, tobacco, turkeys, and the muscovy duck, all of which have become part of the economy of the southern tribes. Cassava, in particular, which we know was an important staple food of the Arawak and other South and Central American Indians, though slow in taking hold, has now become an extensively planted crop, particularly in south-eastern Nigeria.

It is frequently asserted that the peculiar arts of Benin—casting in bronze, etc., were introduced by the Portuguese. I think there is now no doubt that both the methods and motives can be traced back both at Benin and still more at Ife to periods long anterior to the Portuguese arrival.

Northern Nigeria is far more extensive than Southern, and would seem to have been subjected to more external influences than the negro land proper of the south. We find there the extremely primitive proto-Bantus, now mainly driven up into the Bauchi highlands. We also find fairly large bodies of Sudanic invaders. Time was when one of these Sudanic tribes, namely the Jukuns, a people very similar to the Yorubas, having most of their characteristics, had widely extended domains. The Jukuns, whose centres were in the Benue valley, in the year 1600 captured the city of Kano and ruled most of the Northern Provinces. Nowadays, the Jukuns are a small and not very important tribe.

West of the Jukuns another important people of Sudanic origin, the Nupes, were remarkable for their metal craft. Bida is their centre, and in that place their traditional skill in this art is still maintained.

But all this is history, and the dominant peoples of Northern Nigeria to-day are the Muhammadans who for the most part are not pure negroes, and in some cases are not negroes at all. There are to-day in Northern Nigeria at least 5 million people who speak Hausa. Hausa is neither proto-Bantu nor Sudanic but Hamitic, variously enriched by Semitic influences, the latter, I suggest, having come in with and subsequent to the rise of Islam. Of the 11 million people of the Northern Provinces approximately 70 per cent. are Muhammadan.

The Hausas are a nation and not a tribe. They are of very mixed blood. They have a lot of Sudanic negro in them, but the mixture of blood is still a problem. This mixture appears to have come from three directions: first, down the Niger, ultimately from Morocco; secondly, across the Sahara from the Berbers and Libyans of the South Mediterranean; and thirdly, from the east *viâ* Lake Chad. First the Hamites, and then the Arabs.

Still the Hausas with their long robes and large turbans, their well-built if squalid and congested towns, their genius for trading and their cereal cultivation, are to-day a nation with common characteristics of a very definite kind. They form the vast mass of the population of north-western Nigeria. The force that has welded them and made them a nation is undoubtedly Islam.

North-eastern Nigeria, commonly known as the Empire of Bornu, is non-Hausa and very different, except in religious belief. Time was when the Hausas were organized in cities and states of their own, of which it would seem that Kano was always the most populous and most important from an economic point of view, as the chief market of the western Sudan since the fall of Timbuktu, and possibly before that. But to-day all the Hausa states, and some others, such as the Yorubas of Ilorin and the Nupes, are under the rule of Fulani Emirates.

Who are the Fulani? Nobody appears quite to know. They are a long, comparatively straight-haired people, and an occasional pure Fulani girl will have hair down to her waist. Though dark they are definitely non-negro. They are still for the most part nomads, their principal occupation being the herding of cattle and sheep. Their cattle are humped like the Indian ox. There are two main breeds: a white or flea-bitten grey cattle with or without black points is the most characteristic. The indigenous cattle of Nigeria, still found in small numbers in Southern Nigeria, particularly in the Provinces of Ogoja and Benin, are a very small dark non-humped variety, apparently immune from tsetse-borne diseases. None of the Fulani cattle are so immune. There are to-day some three million head of the large humped types of cattle in the four Northern Provinces of Sokoto, Kano, Bauchi, and

Bornu. Their numbers have diminished even in recent times owing to the spread of rinderpest and trypanosomiasis, the two most urgent problems facing the veterinary staff in Nigeria.

The Fulani entered Nigeria from the north-west and are identifiable with the Foulahs of the Gambia. Just about a hundred years ago they threw up a great religious leader, Othman-Ibn-Fodio, who preached a Muhammadan religious revival which he fortified with a Jehad. He became the Sultan of Sokoto with the title of Seriki Muslimi (Lord of all Moslems) and he and his followers conquered all the Hausa states, the Yoruba state of Ilorin, and then carried their power south of the Benue to Yola in south-eastern Nigeria on the border of the Cameroons. Fulani rulers, not only Emirs but Wasiri and Alkalis (judges), etc., were set up by him in all the Hausa states, all nominally under Sokoto.

The history of Northern Nigeria from the death of Othman-Ibn-Fodio to the coming of Sir Frederick Lugard is the history of the re-establishment of the independence of all these states under their Fulani governors as separate sovereign powers. But as late as 1894 the annual tribute to Sokoto from the city of Kano was 100 slaves, 100 horses, 1500 robes, 10,000 turbans, and other similar articles.

Throughout the Fulani Empire the law of personal property is the Sheria law, but real property, *i.e.* land, is still governed by the old customary law of Sudanic times.

The Hausa states were nominally Muhammadan before the revival of a hundred years ago, but up till then this Muhammadanism was somewhat superficial, and many of the old pagan beliefs still obtained. The Koran had become their chief fetish, but little more. At the time of the Fulani conquest the Hausa states were in a condition of political decay, and it would seem that the various dynastic revolutions effected by Othman were effected with remarkable ease. To-day Islam is the outstanding and dominating feature of their civilization.

This has its good and its bad side. Its good side is admirably summed up by Mr. Meek in the work to which I have referred above. He writes:

"Islam has brought civilization to barbarous tribes. It has converted isolated pagan groups into organized nations. It has broadened the outlook, raised the standard of living by creating a higher social atmosphere, and has conferred on its followers dignity, self-respect, and respect for others. The intellectual and political superiority of the Moslem communities is chiefly due to their religion. Islam introduced the art of reading and writing, and by the vista of a wider world enabled progress to take place."

On the other side of the picture stands first and foremost slavery. Until the British conquest slavery was the basis of everything in Northern Nigeria. Slave raiding, slave trading, and slave owning seem to have been intensified as a result of Fulani ascendancy, and during the last hundred years this process has probably diminished vastly the numbers

of the pagan population of Northern Nigeria. Some parts of the country are almost depopulated to-day as the result of the slavery activities of, in one case, an Emir who is still alive.

Whatever we may think of Muhammadanism we cannot get away from the fact that in Northern Nigeria Muhammadanism is tenaciously held and is an all-important formative force in shaping the social and political institutions of the great majority of the people. Whatever may have been the tribal or other concepts governing life in the past, they are altogether overshadowed to-day by the teaching of Islam, which is seen not merely as a religious opinion, but as a system of social order.

Life in Hausaland is predominantly agricultural, and the distribution of the population has been dictated very largely by the agricultural requirements. Owing to the long dry season human habitation has been fixed in towns and villages along the rivers, from whose beds it is possible to draw water in the dry season, when the rivers have ceased to flow above ground. The main agricultural work takes place in the brief wet season, and is therefore mainly rain cultivation, though in some places primitive irrigation is understood by means of the Egyptian shadouf. In north-western Nigeria there are comparatively few permanently constructed wells. In north-eastern Nigeria (Bornu), on the other hand, the art of well-sinking to considerable depths has long been known and practised.

In Hausaland all agricultural work is done with the hand hoe, also of Egyptian type. The main food crop is sorghum, commonly called guinea corn. Cotton has also been cultivated for centuries for local weaving, and now for export. As is well known, ground-nuts have become an important crop, particularly in the economic radius of Kano. The Hausa method of cultivation is by regular ridge and furrow, in contrast with the heap or mound cultivation of the Yorubas and the ridgeless cultivation of Bornu. The Yoruba mound cultivation seems to have been dictated mainly by the requirements of the yam.

In Bornu the main food crop is bulrush millet, and instead of using the Egyptian hoe with its haft at an angle, the people of Bornu use a straight hoe with a sharp point, simply poking the millet seed into the sandy soil. The Kanuri of Bornu seem to prefer using the light land, while the Hausas prefer the heavier soils.

In Hausaland, particularly where the population is dense, as around Kano, cultivation has long been continuous, from year to year, and consequently there is considerable knowledge both of the principle of rotation of crops and of manuring. It is an old custom of the Hausa cultivator to attract the Fulani herdsmen with their cattle on to their land at certain seasons of the year, mainly for the purpose of obtaining the manure.

Trade and transport is only carried on in the dry season. Until our arrival there were no roads, only rough caravan routes, and all transport was done by head carriage or pack-animals. The donkey, the ox, and

the camel were all pressed into this service, and every year considerable numbers of transport drivers with their animals still enter Nigeria from French country to the north for the purpose of earning money with their transport animals.

One of the characteristics of the Hausas is their skill in weaving and dyeing. The dyes employed are indigo, which they grow locally, and the famous red dye so familiar on Nigerian goatskins, which is prepared from the outside sheath of guinea-corn stalks.

The system of taxation which obtains in Hausaland to-day would seem to be of extreme antiquity. Kano chronicles record that even in the thirteenth century one-eighth of the crop was collected from husbandmen, and that jangali, or direct cattle tax, is recorded in the reign of Kutumbi (1638–1648). In the old days most of the taxes were paid in kind, though cowrie shells were widely used as currency. The use of cowries as a medium of exchange still obtains in the market at Sokoto.

Few things strike the casual visitor to Hausaland more than the carrying of a short two-edged sword. This weapon, Roman in type, is seen on most of the transport drivers along the roads. It would seem to be the characteristic weapon of the country.

This reference to weapons leads me readily to the primitive pagans of the Bauchi plateau. These pagans are expert bowmen, and their survival is probably due in the main to their skilful use of the poison arrow. They live for the most part in small huddled villages in defensible places among the hilltops. Wherever possible they plant a stockade of cactus or euphorbia hedges round their settlements. These stockades frequently constitute a formidable labyrinth, and the bringing of these people under administration has been a difficult task. The Hausas build rectangular, the pagans round, buildings.

There is an amazing multiplicity of these pagan tribes, with a corresponding multiplicity of languages which seem to have little or nothing in common with each other. Their standard of civilization is extremely low. Some of them practise circumcision, others do not. Those that practise circumcision would appear to be rather more developed than those that do not. Weapon fetishes are a fairly common feature of their religious cults, and nearly all the tribes practise initiation ceremonies at adolescence. Witchcraft is of course a feature. Their knowledge of agriculture is of the most elementary order, and their principal food crop is the *Digitaria exilis*, locally known as acha, a poor form of cereal peculiar to these people, grown sometimes broadcast and more rarely in terraces. Not only is this grain their staple food, but it forms the material for the manufacture of their cherished beer. The pagans of the Bauchi plateau are great beer-drinkers, and their resistance to the spread of Muhammadanism is not a little due to their apparently all-pervading love of beer.

To the casual observer they would appear to be a cheerful child-like

Phot. C. Rhys

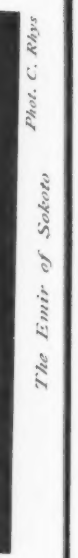
Entrance to Palace, Kano

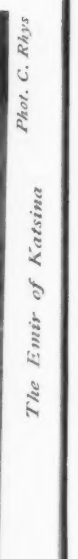
Phot. C. Rhys

Dyeing Pits within the walls of Kano

The Emir of Katsina *Phot. C. Rhys*

The Emir of Sokoto *Phot. C. Rhys*


Phot. C. Rhys
The Emir of Sokoto


Phot. C. Rhys
The Emir of Katsina

people, clotheless and with few wants. They are however easily roused, and when roused become very fierce. Head-hunting was one of their characteristics, and formerly no young man was fitted to become a recognized bridegroom until he had killed his man and brought in the head. It is perhaps natural that the hand of their neighbours was always against them, and formerly whenever they were caught they were enslaved. To-day, however, they are becoming rapidly more peaceful and accessible, and it is astonishing to see them working in thousands in the tin-fields of the plateau. They still practise cannibalism, casual as well as ceremonial, and it will be a long time before it will be possible to induce them to abandon this practice.

My personal belief is that West Africa will accommodate itself fairly happily to the economic changes provided we proceed very cautiously over political and judicial changes. To my mind the most disintegrating force operating in West Africa is the introduction of English law and English judicial procedure in lieu of long-established native law and custom. Nothing tends more to undermine native traditions, society, and organization than the substitution of European for native legal forms. In fact, I hold strongly that the undoubted success of our administration in Northern Nigeria is in the main due to our having interfered as little as possible with the native judicial system.

As far as British administration is concerned Nigeria has become the *locus classicus* of the principle of "indirect" rule. From the very commencement of our rule in Northern Nigeria we have governed the country through the Emirates and their organized native administrations. We have left the administration of justice as far as possible to native courts practising their own law. Ancient systems of taxation have continued. The administration of the Yoruba Provinces has subsequently been very largely modelled on the system in vogue in the north. We guide and direct government through the chiefs and their indigenous native organizations. Native treasuries receiving a proportion of all direct taxes have been the chief instruments. Hitherto the share has generally been 50 per cent., but next year it is proposed to increase this to an average of something like 70 per cent.

In south-eastern Nigeria, owing to the absence of organized chieftainships, owing to the more primitive social and political organization, and above all to the absence of direct taxation elsewhere than in the Cameroons Province, our rule has been more direct than indirect. Efforts have been made, however, to build up a system of native courts for dealing with the less important cases, both civil and criminal. These native court areas which we have established seem to provide the germ whose growth we are endeavouring to foster.

It is now proposed to extend direct taxation to the untaxed provinces and to build up native treasuries, under the combined guidance of leading headmen and our district officers, and with ultimate control by the latter.

The evolution from the isolated village community to the larger political group will necessarily vary in type and speed, but a beginning is just now being made. In northern and south-western Nigeria we are building on the foundation of native forms and traditions. In south-eastern Nigeria we have to create. We may expect steady but slow progress in our processes among the Sudanic peoples like the Ibos, but the proto-Bantus, especially in a Province like Ogoja, will probably present great difficulties. Their primitive ultra-democratic communism with little or no potential native leadership makes indirect rule extremely hard. They are of course much poorer in wealth and in productive capacity than the more varied society of Yorubaland and the Muhammadan north.

Among both the Yorubas and the Hausas a very rapid advance in the standard of living is taking place. The more enterprising individuals, whether cultivators, traders, or craftsmen, are getting rapidly wealthier. Among both the demand for education is proceeding apace. The Yorub is showing special adaptability as a mechanic, and he is now employed in his thousands as engine or motor drivers, fitters, carpenters, and the like.

The Yorubas already show a skill in such crafts far ahead of the Bantus of East Africa, who are presented with similar opportunities. On the whole the Yorubas, chiefs and people alike, show a more ready adaptability to modern progress than the more conservative Hausas. None the less some of the Northern Emirates—Katsina, for example—can be quoted as outstanding instances of the progress brought about by modern technical knowledge in agriculture and commerce. It would be difficult to find anywhere two more remarkable institutions than the Hausa survey school at Kano and the training college for Muhammadan school teachers at Katsina. The standard of quality set in both is far beyond anything I had any idea existed in native Africa, and is a good augury for the future.

Nigeria came under a single administration for the first time on 1 January 1914. The pace we are setting is a hot one. Some five weeks ago the Governor (Sir Graeme Thomson) informed his Legislative Council that he was proposing a continuous programme of new railway and motor road construction, amounting in the case of the former to 150 miles a year and in the latter 400 miles a year.

The impact of this development is likely to be far-reaching and will probably affect the different elements of society in Nigeria differently, and our task must necessarily be to prevent this development having too rapidly disruptive tendencies. We are pouring new wine into very old bottles, and it will be interesting to see how religious beliefs, social and political organizations that have obtained in Nigeria for centuries, will be modified under the stress of this impact.

Before the paper the PRESIDENT (Dr. D. G. HOGARTH) said: It would savour of something like impertinence for me to introduce to you a Minister of the Crown. From the Press, if from no other source, you have learned during these last two or three years of Mr. Ormsby-Gore's indefatigable journeying. I believe that he and his chief, the present Secretary of State for the Colonies, are the two most variously travelled members of the present administration; in fact, they are probably the most travelled members of any administration since Lord Curzon. There is no busier man in London or, indeed, in this country than Mr. Ormsby-Gore, and we are most grateful that he has consented to come and give us a general account of what he saw in the second of his two great colonial tours in Africa, that is, his tour in West Africa. As his time is more valuable than my own, I will not stand in his way but ask him at once to address you.

Mr. Ormsby-Gore then read the paper printed above, and a discussion followed.

The Hon. CHARLES RHYS, M.P.: I do not propose to keep you very long after the extremely interesting address that Mr. Ormsby-Gore has given, but may I very briefly elaborate one or two points? The address was entitled "Some Contrasts in Nigeria," and I think there may be few parts of the world where the contrast between European civilization and primitive peoples is more striking. I suppose that the city of Kano is one of the most astonishing places in the world. Mr. Ormsby-Gore mentioned that the walls of Kano are 13 miles round, and within those walls are not only the houses of the people but also a great deal of agricultural land. Before the British arrived in Northern Nigeria there was, naturally, a great deal of warfare, and it was extremely important that the people should safeguard their food supplies. For that reason they included within their fortifications the very necessary sinews of war. I believe Napoleon said that an army fights on its stomach. To stand on the top of a hill that is within the walls and to look out in the early morning, with the mists over the town, to listen to the sounds rising up from the native quarters, is one of the most extraordinary experiences I have ever had.

The Emir of Kano, and indeed all the Emirs of any importance, maintain considerable state still, and when we went to visit the Emir of Kano he sent a troop of his cavalry bodyguard to meet us at the gates, and we were taken through the streets of the town at full gallop, our motor car going as fast as the horses could gallop. They still have very proper respect for the white man, and the form of address not only to the white man but to any important native chieftain is that of "Lion," but should you be of greater importance you may be addressed as "Bull elephant."

There is, I suppose, in Kano something more like 'The Arabian Nights' and the city of Baghdad in the days of the Caliph than I imagine you could see in Baghdad to-day, for I am informed that the latter city is being spoiled from the picturesque point of view.

I suppose Ibadan is the most remarkable native city. It has a population of about a quarter of a million, and I believe it is the largest pure native city in the whole of Africa. Though I have touched on the picturesque side I do not think that such an audience as this should go away with the impression that our tour was nothing but a series of ceremonial visits and the taking of interesting photographs. There was the side of investigation of administration, of health, of education, and all the hundred and one services which we are running in that part of the world. Nigeria produces coal, mostly for internal consump-

tion at present, tin, cotton, palm oil, and ground-nuts. Palm oil is very largely used in tin-plate works in this country and for soap-boiling.

I would like to supplement the closing words of Mr. Ormsby-Gore's address. We are pouring new wine into old bottles, and the interesting thing is that it is nearly all the work of the present century. Therefore the present administrators are watching grow up the work of their own hands. They are not suffering the fate of so many administrators of the past who have not lived to see the full fruit of their efforts. We have, owing to our modern conditions of transport and our modern scientific knowledge, the rapid turning of a part of what I suppose could be truthfully called "the Dark Continent" into a country in which a European can walk from one end to the other carrying a walking-stick. It is not so many years since it was necessary to have armed expeditions to subdue tribes which had not been placed under our administration.

One of the things that struck me more than anything else is this: that because a man has a black skin he is not necessarily the same as another man who has a black skin. The people of Northern Nigeria are as different from the people of the south as, shall I say, the Scotsman from the Italian. The administrator will have to realize that he is dealing with different races, races which differ as much as the white races do. Therefore I think the colonial tours are of the greatest importance, not only to those who have the honour of sitting in the House of Commons, but to those who are members of the Colonial Office, because they will be there when, perhaps, our constituents may prove refractory! That tour gave an inside knowledge of part of our Empire which I fear is too little known.

The PRESIDENT: We have with us this evening Mr. Webster, who has had very long experience of Sokoto and, I believe, spent twenty-five years in Nigeria. Therefore perhaps he will find it difficult to tell you anything about the country.

Mr. F. G. WEBSTER: The President has said I shall probably find it difficult to tell you anything because I have been so long in the country and especially following on the able summary given by Mr. Ormsby-Gore, which he has been able to give you after spending six weeks in Nigeria as against my twenty-five years. Mr. Ormsby-Gore has spoken a great deal about the contrasts and the movement of the people. I am afraid we know very little about it, in spite of the efficient work of Mr. Meek, Mr. Talbot, and many others. He has mentioned the brass-work, especially that of Benin. We found the art of casting in brass still existing amongst the Lala tribe 40 miles north of Yola, though the people were so primitive that they went in a state of absolute nudity and lived in the most primitive way possible. Soon after we opened up the country in 1909 I went back there again and was presented with a little set of brass figures, beautifully cast and including a portrait of myself and my dog, faithful in the smallest details, even to the buckle on my belt and the crosswork on my topee. They apologized for giving me so few, stating that the supply of cartridge cases which the British had used had run out! Later on we found two very interesting figures, one representing a winged monkey and the other some curious monster with the legs and wings of a bird, apparently a pelican, and the body of a woman. How or from whence they got their art we have not the least idea.

It might interest you to know that in Sokoto there are still the remains of two stone citadels or fortresses. One was built by Kanta the revolutionary, who freed his people from the yoke of the Songhai Empire, of rough stone, more or less circular in shape and surrounded by a moat. The building

of Keawu in the Zamfara country, on the other hand, shows signs of considerable skill in masonry. The stones are roughly shaped and there is a wide road hewn in part through solid rock leading up to the chief gateway.

I gather I am expected to say something with regard to the Fulani. The ruling caste I do not think you can consider as being pure Fulani. Of the photographs shown us the man certainly was more Hausa than Fulani; the woman was nearer the Fulani type. The true Fulani is still nomadic. He lives for and by his cattle. They are almost his gods. Who or what the Fulani are, we do not know. The latest theory is that they were the remnants of the old Kushite invaders. They are a most interesting people, but I am afraid we know very little about them or what their language is. Some say the latter is the prototype of all the Hamitic languages. All we know definitely about them is that they were long resident between the Niger and the Senegal rivers, and eventually came down, abandoned in part their nomadic life, and took over the administration of the Hausa states to a large extent. On the other parts of the paper I do not feel qualified to say anything.

Mr. FRANCIS RODD: There is only one point on which I feel competent to speak. Mr. Ormsby-Gore mentioned the contrast between Southern and Northern Nigeria. I think he suggested, by implication, that the distinction was fairly modern on account of political difference in administration between the old colony and protectorate of the south and the area administered by the Niger Company. But I think there is perhaps another reason: the old Emirates of Northern Nigeria owe the civilization, which we found when we went there at the beginning of this century, to contact with the Mediterranean and not to contact with the sea-coast. There are many proofs of that; partly military, in that all the invasions of Northern Nigeria have taken place either from the north-west or from the north-east; a few, perhaps, from the north. I am not aware that any took place from the south. Secondly, trade was almost entirely between the Mediterranean and Northern Nigeria, and practically non-existent between Northern and Southern Nigeria until developed by Europeans. Consequently, you have the Emirates of Northern Nigeria facing north with their back, as it were, to a wall of almost impenetrable jungle through which they had no contact. Early explorers all came into Northern Nigeria from the north. It was only Clapperton's second expedition that led him up from the south through the bush. Therefore it is possible to suggest that the contrast is really of considerable antiquity, and that the making of railways and contact between the sea and the north are innovations which perhaps requires as careful watching as some of the other difficulties that Mr. Ormsby-Gore suggested, such as the contact of pagan and negro with rather more civilized law, and, as Mr. Webster will agree, the considerable differences of opinion which exists between the negroes of the south and the semi-negroid or semi-Semitic people of the north.

Sir HENRY GALWAY: I am afraid you will find me a little out of date. Mr. Webster spoke of going to Nigeria twenty-five years ago. Well, I left Nigeria twenty-five years ago, having spent twelve years there. I happen to have been about the third or fourth officer appointed by the late Lord Salisbury as Deputy-Commissioner to the Oil Rivers Protectorate, and the Benin country was my particular area. Mr. Ormsby-Gore spoke about Benin City, and I had the good fortune in 1892 to go up there on my own account. I went as a guest of the King. At that time there were not more than six or seven men living who had ever been there. The only hospitality I received when staying in the City (for five days) consisted of eggs sent me every morning

by the King, which were fit only for electioneering. I made a Treaty with the King; but no white man visited the City between my stay there and the punitive expedition of 1897, after the massacre of Mr. Phillips and his companions.

Mr. Ormsby-Gore said no horses lived there, Trypanosomiasis presumably keeping them out. I was twelve years in Nigeria and I never saw a tsetse-fly there! I had two ponies, which I kept in the Opobo district, and they lived for about three weeks. It was not the trypanosome or the tsetse fly that caused their deaths, but something in the vegetation which contaminated the water, and the ponies got paralysis of the loins. Curiously enough, about nine years afterwards I was Governor of Gambia, one of the tsetse-fly centres, so I speak of the fly with a certain amount of experience. There you have the tsetse-fly, the *Gambiense*, and in certain districts where the fly abounds, it is impossible to keep horses; but outside such areas you see groups of fifty or even one hundred men riding.

Southern Nigeria was called the Oil Rivers Protectorate in 1891 when Major Claude MacDonald was appointed Commissioner. None of us liked the name very much, and so the Foreign Office changed it to Niger Coast Protectorate, and that remained until 1898, when the Colonial Office took it over from the Foreign Office. Then we became Southern Nigeria, and eventually merged into Northern Nigeria. Southern Nigeria was the smaller, being about 64,000 square miles, whilst Northern Nigeria was about 300,000 square miles.

The Benin bronzes are very interesting to me because I happen to have a good number of them. I went up with the punitive expedition after the massacre in 1897, as Assistant Intelligence Officer to Admiral Harry Rawson. We took the City on 18 February 1897. We found bronzes there in enormous quantities and the most beautiful ivories also. Unfortunately, on the second day on which we were in the City, the whole of the King's portion was burnt down, through some careless person (carrier probably) having dropped a match, and tons of ivory were burnt to ash. We sent 300 bronze plaques to the British Museum, and they wrote a volume about those bronzes and ivories. Mr. Ormsby-Gore touched on the question of how the Bini learned the art, and said it went right back into the past. He is right. The British Museum authorities think that the art was probably taught the Bini by the Phœnicians, who were itinerant pedlars, as it were, and who travelled all over the world.

In 1898 I happened to administer the Government of Southern Nigeria for eleven months during the time that Sir Ralph Moor was home on leave. I went up to Benin City several times. I asked the King's brass-maker—the King was then a fugitive—if he would make me a bronze, and he said he could only copy. I gave him a bronze to copy, and he faithfully reproduced every detail; but the piece he produced looked like a Brummagem article. The Binis were also very clever in copying in the old days. I sent a pair of cannon to the Tower of London—Lord Dillon was curator at the time—and I told him I thought they were a pair of old Portuguese cannon. He said he was not surprised I should think they were a pair, but one was genuine, about the sixteenth century; the other a copy, which must have been made in Benin City.

It has been very interesting to hear Mr. Ormsby-Gore talk about a country one is very attached to. In the old days we only laid the foundation, and, as Mr. Ormsby-Gore said, it is the men of the present contury who have the credit of having built up Nigeria as it is to-day. I can assure you the nine years we did in the last century involved pretty hard work, and we had no motor cars or railways! In fact, punitive expeditions were the order of the year—I think

every year we had one. It is good to think they are no longer required; but I suggest that some of the credit is due to those who laid the foundations and did the pioneering work. West Africa possesses an indefinable charm. Once you have tasted the fetish water, you have a longing to return there!

The PRESIDENT: I will ask Mr. Ormsby-Gore if he has anything more to say. I think the audience would be interested if for two or three minutes he would show us on the map some of the practical results of his expedition, particularly where the new roads and railways are to go.

The Rt. Hon. W. G. A. ORMSBY-GORE: I must first reply to the remark of Sir Henry Galway in connection with tsetse-fly. I was bitten by a tsetse-fly and killed it on my hand within 3 miles of Benin City. There are a great many varieties. I cannot vouch for the following story, though I was told it in Nigeria. When the Northern Provinces headquarters were at Lokoja some one made a polo ground and had a certain number of ponies there. Everything went well until they came to the conclusion that the polo ground wanted rolling. They got two of the Benin cattle brought up the Niger on a steamer. The cattle rolled the ground beautifully and lived for many years, but every pony was dead within three weeks. Some of these cattle have been tested, and their blood was found to contain trypanosomes. As a matter of fact, I have seen dogs in East Africa go in the loins like the ponies Sir Henry Galway mentioned from trypanosomiasis. Probably one of the most important campaigns of the Colonial Office, from Gambia to Zululand, is the campaign against tsetse. In the past there have been frequent failures to diagnose disease of both man and animals as trypanosomiasis. My point is that the infection of the tsetse and other flies with different forms of trypanosomiasis seems to have been spreading in comparatively recent times.

As to railways, the railway actually in course of construction is in the direction of Sokoto. It has been surveyed, and material ordered, to a place called Gusau. In the Governor's speech to this Legislative Council five weeks ago he foreshadowed that they will not stop at Gusau, but take the railway forward so as to tap a place called Kara-na-Moda and on to the place in which I first met Mr. Webster, namely, Talata Mafra, on the Sokoto road, which may there tap that Zamfara valley containing the stone remains which Mr. Webster referred to.

Then they are going ahead with carrying on the main line from Lagos to Kano to Hadeija, about 80 miles north-east of Kano, and that will bring the area down the Hadeija river more within economic radius of the railway system.

Then there are two railways in the south in the Governor's sanctioned programme; a railway in the cocoa-growing area between Ife and Benin in the Province of Ondo, and the railway that is to be built either from Aba or from Port Harcourt to Owerri or Onitsha. Such a branch would eventually link up with the Niger. We can only do about 150 miles of railway a year on account of labour, permanent staff, and the rest. Other projects you will see in the report that I published, including a railway from Oturkpo to endeavour to open up the Munshi country.

The great market for ground-nuts is Kano. I have heard of ground-nuts grown in the Munshi district being carried, long before the Eastern Railway was thought of, by caravan all the way up to Kano for sale there, and then being brought down by railway again for shipment. Apart from that, the agricultural research officers at Ibadan have now practically isolated a very much improved type of native cotton that will grow in the area south of the Benue

and the Niger. The American types of cotton are grown in the north, in the area of which Zaria is the centre. American cotton has been tried in districts where native cottons have been grown for centuries in the south, but it is not successful there, as the local conditions and pests are harmful to it. The Agricultural Department have now obtained, by seed selection and by breeding, an improved local native variety that will grow in the south, superior to the existing native cottons and to most of the American varieties. It is known as "improved Ishan."

The other eventual railway which, when all those branches which are immediately paying and economic propositions have been worked out, is that from Lafia towards Lake Chad. That is a big proposition involving about 500 miles, and such a railway will cost a great deal, but it is the only thing that will eventually tap the million people who live in the Chad area, and will develop all the country between the Bauchi plateau and the Benue. There are in the eastern area signs of mineral deposits. Bornu is good cattle country, and if the railway gets there it will be one of the most go-ahead and productive parts of Nigeria.

The PRESIDENT: Mr. Ormsby-Gore has once more shown that same remarkable power of taking a wide sweep over country which he showed—not to this audience, unfortunately—in speaking to various assemblies about East Africa. If we have made a joke about his having been in the country only six weeks and therefore being able to give a general account of it, while Mr. Webster, having been there twenty-five years, is unable to do so, we know in all seriousness that Mr. Ormsby-Gore's success is due to his confining himself to general features which are assured and ascertained; whereas Mr. Webster, in the course of twenty-five years, has gone beyond these into matters of detail about which he and, I think, also Mr. Francis Rodd have showed quite clearly we have not yet full knowledge—details in particular which concern the semi-archæological, semi-ethnological question about the origin of the Nigerian peoples. All I can say is that I have got a general impression that not the Arab people but the Arab influence has penetrated a very long way indeed into that Nigerian country. I ask how the name Yoruba, which is well known on the other side of Arabia, has come down there. Other names too, like Ibadan, have a curiously Arab sound. The Arab was apt to be on the top of streams composed of a great number of other people who were not Arabs; and all kinds of languages have come down in the wake of the Arab and under his leadership. Mr. Ormsby-Gore has cleverly and wisely chosen a scheme of contrasts in order to show us what is ascertained by the best authorities and what is the accepted gospel now in His Majesty's Government about this great and important dependency. He has done that as, I believe, no one else could have done it for you to-night, and I hope you will express your gratitude.

NEW ROUTES ON RUWENZORI

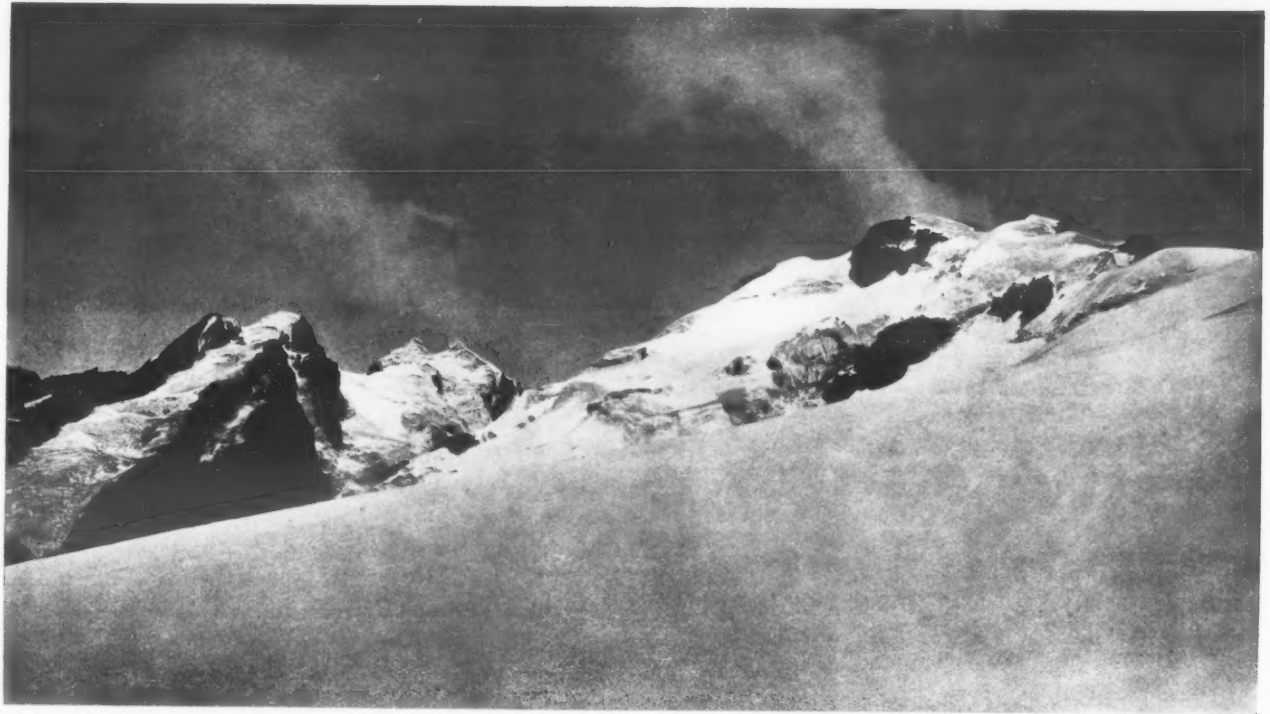
Captain G. N. Humphreys

Read at the Meeting of the Society, 21 February 1927. Map follows p. 604.

IT is remarkable that for more than twenty years explorers were operating in the neighbourhood of the Ruwenzori range without discovering the snows It is perhaps more remarkable that they attached

Phot. Dr. D. Garnett

The Snows of Ruwenzori from Hima, about twenty miles east by south from Mount Baker



Edward Peak, Mount Baker (right), and twin peaks of Mount Stanley in distance

Phot. A. G. Ellis

so little importance to the accounts of natives of mountains whose summits were lost in the clouds, or were shining white, or were covered with salt. When in 1888 Stanley had his attention drawn to a mountain the summits of which were visible and, according to the native, covered with salt, he even then at first thought he was looking at a remarkable cloud formation, and the full extent of his discovery only slowly dawned on him.

It was not until 1900 that the snows were reached for the first time by Moore. Between that date and that of the expedition of the Duke of the Abruzzi were many expeditions of which the most important was the British Museum Expedition of 1906, members of which made the first ascents in the range, climbing two peaks which were afterwards named Wollaston and Moore Peaks. In 1906 the Duke of the Abruzzi, with perfect equipment, Alpine guides and porters, and good fortune in weather—he had ten fine days in a month and a half—carried out an entirely successful piece of exploration: climbing the highest peaks and bringing back material for a map showing the position and extent of the six snow mountains of the range with their peaks and glaciers.

During the next twenty years no fresh ground was broken in the range, and no peak re-climbed. Last year, however, two small expeditions were able to add slightly to the knowledge of the range. The first expedition was undertaken jointly by Mr. D. Stedman Davies, of the Uganda Civil Service, Mr. E. H. Armitage, and the writer; it started at the end of January and returned—nine days overdue—on March 9. Preparations included the collection at Fort Portal of seventy outfits of sweaters, vests, shorts, and blankets for porters, with fifty extra blankets and fifteen sets of boots and stockings. Food for the Europeans was ready packed in light loads, about 45 lbs., and loads of millet flour had been collected at Ibanda.

The porters collected at Fort Portal were replaced at Ibanda by Bakonjo porters, as these men were accustomed to the valleys of the range, where they hunt hyrax. Early in the morning after the arrival of the expedition at Ibanda a party of natives was sent off with grass knives to cut a way through the vegetation on the lower slopes, in advance of the main party, which started the same afternoon. The first night was spent at Mihunga, which had been the headquarters of the British Museum Expedition and is the last inhabited spot on the way to the snow-peaks. The next day the expedition passed through some of the typical zones of vegetation which begin and end so abruptly.

In the first zone after Mihunga a podocarpus tree was conspicuous, and there were many brilliant flowers, including a pale mauve climbing solanum, a begonia, and a purple terrestrial orchid. Next was a zone of bracken which had a curiously English effect. This gave way to a zone of mixed vegetation, and from that the expedition passed suddenly into the bamboo zone, which would have been impenetrable but for the path which had been cut through it. The stems of the bamboo were

Edward Peak, Mount Baker (right), and twin peaks of Mount Stanley in distance *Phot. A. G. Ellis*

about 30 feet high and about 5 inches in diameter and of a beautiful blue-green colour. A greenish light filtered through the foliage, and the ground was covered with maidenhair ferns and a balsam with a large shell-pink flower, and here and there were tall arums with the spathe striped cream and pale green. That night, still in the bamboo zone, Nyinabitaba was reached. This is the first of the rock shelters which are so typical of the range. The name means " Mother of Tobacco," and was given by the native hyrax-hunters because of the use made of the shelter as a store during their hunting trips.

The next day the Mobuku, the Mikasabira, and Bujuku rivers were crossed and the most beautiful and interesting floral zone reached. Here were species of ranunculus like the English spearworts, a cardamine like lady's-smock, a viola like the dog violet, bog-orchises, docks, nettles, a rubus with fruit bigger than the loganberry and flowers as large as a wild rose, and two species of tree hypericum, one with yellow flowers and one with large flowers of a flaming orange.

The intention had been to reach the rock-shelter Nyamuleju that night, but on teaching the shelter Kanyasabo the porters refused to go farther, saying that Nyamuleju was " bad," and that every one died there. The next day's journey was mostly along the Bujuku river through swamp, which consisted of tussocks of rush about 3 feet high, and between them mud covered with moss. One could jump from tussock to tussock and eventually land thigh-deep in the mud, or one could plod steadily calf-deep through the mud. The porters sat on the tussocks and dropped their loads in the mire.

That evening the shelter Kigo was reached. The porters had been out of hand and causing trouble by throwing down their loads and threatening to desert ; and matters now came to a head by their refusing to continue the journey unless they were supplied with outfits. It was contrary to custom to provide more than blankets for porters going to the glaciers and back, and only sufficient outfits had been brought for such porters as were to remain with the Europeans at the camp which it was intended to establish in the neighbourhood of Stuhlmann Pass. The cause of the trouble was partly that most recent expeditions had been only to the glacier and back, whereas this expedition was known to be planned for a longer stay in the mountains, and partly that an expedition a short time before had encountered a snow-storm while crossing the Scott-Elliot Pass and four porters had died of exposure. Eventually it was decided to divide the porters into " blanket men " and " outfit men " ; the former were to carry provisions between Nyinabitaba and Kigo, and the latter were to go on with the Europeans and to fetch stores from Kigo to the advanced camp when necessary.

The next day Bujuku shelter and lake were reached. This was the last shelter known to the porters and normally used by hunters. While this camp was being established a reconnaissance was made up to

Stuhlmann Pass in order to find a suitable site for an advanced camp. Just south of the pass at the foot of Mount Speke, a shelter was found which had been used by natives, as was shown by the presence of two unbroken cooking-pots. The porters did not know of this shelter, and were puzzled by the presence of the cooking-pots. Just beyond the pass, on the same side of the valley, another shelter was discovered. This showed no signs of human habitation, but had been in long and recent occupation by leopards. The next day camp was moved from Bujuku shelter to Leopards'-lair. Owing to the mutinous state of the porters this took most of the morning. In the afternoon a reconnaissance was made up Mount Stanley, but heavy rain and thick mist prevented useful exploration. Until that evening, owing to continual mist and frequent rain, the snows had not been visible, but at about 7 o'clock, when it was nearly dark, the sky cleared and the snows of Stanley plateau were seen.

The vegetation of this, the highest, floral zone of the range is characterized by the omukoni tree, a species of senecio, herbaceous lobelias about 15 feet high, shrubby everlastings, a galium like the English cleavers but with purple berries, a sweet-scented arabis, an herbaceous senecio, like ragwort, and a true umbellifer. The most useful plant is the omukoni tree, which provides abundant fuel, though the wood burns with little flame and much smoke. The large leaves on fading fold back against the stem and the dead leaves are kept dry by the dying. These dead leaves are valuable for starting fires and for bedding. There was not enough space under the rock-shelters to pitch a tent, and elsewhere all level ground is swamp. Full advantage was taken of the dry omukoni leaves, but it was only a matter of time before the weight of one's body brought water to the surface.

The natives mostly did not wear the clothes issued to them, but made them up into neat parcels to sell on their return. Such natives as wore the clothes invariably took them off at night, because crouching over the fires of omukoni wood they felt the heat better on their naked bodies.

The first attempts were made to climb Mount Stanley by either the north-north-east or north-north-west ridges, both of which led to the precipitous northern face of the mountain. The obvious line of approach was from the south, but as the northern ridges were unexplored they offered more interest. Later both ridges were crossed and the glacier reached which flows north-west from the col between the two highest peaks. This glacier offered a route to the summit, but it would have been necessary to establish a high camp or transfer the main camp to west of Mount Stanley, and, with the porters prepared to desert at any moment, this project had to be abandoned. All these climbs on Mount Stanley had been in thick mist and frequent rain, and it is possible that with clear weather a way up one of the northern slopes could have been found.

The next attempt was on Mount Speke. During the attempts on Mount Stanley camp had been moved to " Mid-valley " rock-shelter, which had been discovered in the middle of the upper part of the valley running north from Stuhlmann Pass, and this camp was equally convenient for the attempts on Mount Speke. Occasional glimpses of this mountain showed three main peaks. Of these the centre peak had been climbed by the Italian expedition and named Vittorio Emanuele. The north peak, unnamed, had not been climbed, nor had the southern peak, which the Duke had named Johnston Peak. The attempts were made by the north-west ridge. It was necessary to cut steps up the slope, and on two days the expedition was driven back by snow-storms which obliterated the steps which had been cut, so that they had to be recut on the morrow. The third attempt, on February 16, was successful; the northern peak was climbed and the high ridge traversed to Vittorio Emanuele Peak, which was also climbed. From the summit of each of these peaks and from the ridge between them it appeared that the peak to the north was slightly the higher, but at neither peak was the other visible long enough to enable observations to be taken. During this day little snow fell, and at times the mist was thin enough to enable the position of the sun to be made out and its warmth felt. This was the only occasion during either expedition when, while on the snows, the warmth of the sun could be felt.

The expedition now moved camp to " Cooking-pot " rock-shelter. It was not possible to leave this to the porters, and a day was lost, which loss was especially unfortunate as it was the only completely fine day during the expedition. From this camp attempts were made to reach Margherita Peak by the south-eastern ridge, which leads directly to the summit. These attempts were made in continuous mist and frequent rain or snow, and they failed, though in fine weather it is likely that a way could be found up this ridge, which offers the most direct route to the highest peak.

Only five days were now available for climbing. The easiest route to the Stanley plateau is the south-eastern ridge, which was ascended without difficulty on each of these days and each day spent wandering about the snowfield in dense mist. Not the slightest glimpse of the Twin Peaks was gained until the last day, when in the late afternoon the expedition was on its way back.

The main divide of the range runs through each of the six snow mountains, Gessi, Emin, Speke, Stanley, Baker, and Luigi di Savoia. The passes between the mountains were named by the Duke of Abruzzi: Roccati, Cavalli, Stuhlmann, Scott-Elliot, and Freshfield. Of these two—Roccati and Cavalli—had not been crossed. To the north of Roccati Pass lay the largest unexplored area in the range. The highest part of the range had not yet been crossed; expeditions to the snows from the east had returned to the east, and those from the west to the

Phot. E. H. Armitage

S.E. spur of Mount Stanley (right), and Mount Baker (left) from Stuhlmann Pass

Phot. G. Oliver

High Camp on Mount Stanley

Phot. G. N. Humphreys

Second lake in valley west of Scott-Elliot Pass

Phot. G. N. Humphreys

Johnston and "Trident" peaks, Mount Speke

west. The objective of the expedition was now to travel over Cavalli and Roccati Passes and to complete the crossing of the range through the unknown area. Word was sent back to Kigo and Nyinabitaba for the men to break up camps and return to Ibanda. More detailed plans depended on the natural difficulties encountered and on how soon the porters deserted.

The first day we struck camp at Leopard's-lair, recrossed Stuhlmann Pass and the north-western ridge of Mount Speke, and reached Cavalli Pass. This is the ridge joining Mounts Emin and Speke. As day drew on and no rock-shelter was discovered it was considered advisable to descend to the nearest valley, which lay to the north-west. The way to the valley was in most places precipitous, and it took four hours to get the party down the cliffs. It was now nearly dark, and as no rock-shelter could be discovered we had to camp in the open. Snow fell at intervals during the night, but luckily there had been time to collect fuel, and fires were kept burning. Next morning the ridge was reclimbed and a difficult descent was made into the valley running south from Roccati Pass. Proceeding up the valley a small lake was discovered. There were three wild duck on the lake, the first so far seen. Near the lake was a rock-shelter, and a camp was made here rather than risk another night in the open.

Next morning, just as the expedition was ready to start the men refused to go on. Some stood in groups shouting, others ran away and hid. The three headmen were loyal but without influence over the men. When the Europeans announced that they were going on alone some of the men volunteered to go with them, but when a start was called they changed their minds. Eventually tent, bivouac, rifles, blankets, spare food and clothes, etc., were left in the rock-shelter, and the Europeans started off, each with only a waterproof cape and a ruck-sack containing food and photographic material. The three headmen and three porters followed, carrying only their own food and blankets.

The valley north of the lake was choked with enormous boulders which had fallen from the cliffs above, some quite recently, for the leaves of the omukoni trees broken by the falling rocks were scarcely faded. At the head of the valley the expedition reached a sharp ridge overlooking the lake which had been seen by the Italian Expedition from Bòttego Peak, Mount Gessi. This lake was in a small self-contained basin, surrounded by precipitous or overhanging cliffs. The rest of this day was spent in finding a way round this lake, it being necessary to climb up to the snows of Mount Gessi before this could be done. Rain fell steadily throughout the day. By dusk the northern rim of the basin was reached, and here a large rock-shelter was discovered, the largest and driest yet found in the range. It was too late to cut wood, but fortunately some dead omukoni trees were found which had fallen inwards under the rock-shelter. Nothing had been seen of the six natives

since soon after the start, but after dark they arrived at the shelter, having followed our tracks. One had fallen and lost his load, which had dropped into the lake. As soon as the fuel was burnt up it became very cold, as the shelter was only just below the snow-line.

Next morning the expedition completed the crossing of the Roccati Pass and climbed down a steep slope into a valley running first north and then north-north-east. Following a stream round a spur of Mount Gessi, a lake about a mile long was discovered, larger than any lakes previously found in the range. Following the shore of the lake, and the left bank of the stream issuing from it, another and rather larger lake came into view. After passing this lake the expedition left the valley and moved north-west across a treeless plateau carpeted only by two species of alchemilla growing about 3 feet high. Here we saw one of the Ruwenzori red duikers, a race of duiker which is peculiar to the range, and of which a specimen has never been shot, although they have often been trapped by natives. The porters were now expecting to find tracks of native hyrax-hunters from the Congo side of the range, and they frequently left the Europeans to follow supposed tracks. Across the plateau a valley and rock-shelter were found, and here a camp was made. The next day we followed a valley, reached the bamboo zone, and made a camp in the open. The natives had not been seen during the day, as they had been following possible tracks which had however faded out, but they reappeared after dark.

Next day we reached the zone of mixed vegetation immediately below the bamboo zone, and progress here was slow. For some hours we had to pass through a belt of nettles 5 feet high, which stung painfully even through thick clothes. The valley had now narrowed down to little more than the river-bed, and night was spent camped beside the stream.

The next day the sides of the valley became so steep that it was necessary to wade down the river-bed. In the water a dead duiker was found, so far decomposed that flesh remained only on one leg, which was brought along by the porters for food. The walls of the gully were in most places vertical, but where tributary streams flowed into the river the cliffs could have been scaled, and that native hunters sometimes visited the valley was presently clear. In crossing a piece of level ground beside the river a giant forest hog was found with its foot caught in a noose. The animal was immediately killed by the natives with heavy stones and grass knives and large portions of its flesh brought along. It was not possible to find the track by which the native hunters had reached the valley, and the expedition continued to wade down the river-bed. Shortly afterwards a dead and much-swollen rat was found in the stream, and added to the supplies.

That night was spent on a piece of marshy ground beside the stream, and it rained at intervals throughout. The next day also was spent wading down the river. Cascades became more frequent, and it was

often necessary to climb along the face of the cliff to avoid these waterfalls. The valley was strewn with tree-trunks which had fallen from above, and on one occasion a trunk wedged across the stream made a convenient bridge across a cascade. Towards evening the cliffs on either side were less high, and it was clear that the foothills were near. At one point, climbing up the side of the cliff to find a way past a cascade, a distant view was obtained of the sunlit plains of the Congo. Later on, to avoid a cascade which could not be passed, it was necessary to return upstream until a way could be found up the cliffs.

By the time the ridge was reached it was dark, and the night was spent at a spot where the slope was so steep that we had to be anchored against trees to prevent sliding downhill. The next morning, warm and dry for the first time for over a month, but suffering from thirst, as no water had been found since leaving the stream, the expedition pushed its way downhill through elephant grass out on to the native track which skirts the foothills. This track was followed northwards, the Bwamba Pass over the northern foothills crossed, and Fort Portal reached in two days.

The second expedition was undertaken in July of the same year by Mr. E. H. Armitage, who was on the first, Messrs. R. T. Wickham and N. F. S. Andrews, of the Uganda Civil Service, and the writer. At the last moment the expedition was fortunate in obtaining the services of Mr. G. Oliver, who came in charge of the porters.

At Ibanda the porters who had deserted us before were most anxious to rejoin. The six men who had kept with us had been well paid, and our success in crossing the range had entirely restored their confidence. This time the men gave no trouble. The same route was followed, a base camp established at Cooking-pot rock-shelter, and a high camp at about 15,000 feet at a spot on the south-eastern ridge of Mount Stanley, which had been selected during the previous expedition. The porters slept at the base camp, but brought up fuel and food each day to the high camp. Below, on the Congo side of the ridge, the site of the high camp of the Italian expedition could be made out. Each day the expedition ascended the south-eastern ridge and reached the Stanley plateau. During each day there was almost continuous mist and frequent falls of snow. Occasionally glimpses could be had of the Twin Peaks, and each day some progress was made in their direction; but most of each day was spent waiting on the plateau in dense mist for some clearing which might allow progress. Luckily no snow fell heavy enough to obliterate the tracks of the day before, and each morning after the first it was possible to go straight to the limit of the previous day's journey and there to await a thinning of the mist which would allow further progress.

On the eighth day the Twin Peaks were reached, just twenty years

and a day after their previous ascent by the Duke. The route followed was first a descent to the Margherita Glacier, then an ascent of the south-eastern ridge of Margherita. Just below this ridge was a cornice which presented some difficulty. The ridge was then followed without difficulty until just below and to the north of the summit, where progress was checked by a more formidable cornice, up which however a way was found. From the summit of Margherita a descent was made to the col between the Twin Peaks, and from the col the steep slope was climbed to the summit of Alexandra Peak. The actual summit of this peak was found to be on a cornice overhanging the entrance to a large rock and ice cave.

Immediately after the ascent of the Twin Peaks the high camp was struck and another high camp formed just below the snow-line on Johnston Peak, Mount Speke. On the way to this camp we climbed a jagged rocky peak at the extreme south of Mount Speke, known to us as "Trident Peak" from the shape of its summit. The next day Johnston Peak was climbed without difficulty. On the way up the Bujuku valley, on arrival at Kigo rock-shelter, a small snow-covered peak had been seen which appeared to be just behind the hills immediately north of the shelter. In attempts to locate this peak Mount Johnston was reclimbed twice in the next three days, but mist prevented any view in its direction.

Camp was now struck and the whole expedition crossed Scott-Elliot Pass *viâ* the site of the high camp on Mount Stanley. This required a higher climb than the usual crossing of the pass, but the way was easier for the porters. A camp was formed at a rock-shelter beside the lower of the two lakes on the Congo side of the pass, and that evening for half an hour before sunset the sun was seen for the only time during this expedition. The next day we crossed Freshfield Pass and made a high camp just below the snow-line of Mount Baker, the natives camping at a rock-shelter lower down. The next day, in the usual mist and with occasional falls of snow, we ascended Edward and Semper Peaks. On the former peak was a card of the Duke of the Abruzzi, where it had remained untouched for twenty years, and on the latter was a note written by one of the Duke's party. The next day, from the same camp, we climbed Stairs and Sella Peaks of Mount Luigi di Savoia. The expedition then returned by the Mobuku valley, visiting Moore Glacier on the way.

Both expeditions had experienced the bad weather which had hampered all earlier visits to the range. In February and March we had one quite and one nearly fine day in about a month and a half. Only one day had been quite free from rain or snow. During the expedition of July it rained or snowed every day, and the sun was only seen for half an hour on one occasion. On neither was it possible to take observations from the summit of any peak. While we were away fine weather was

Phot. G. N. Humphreys

Looking from Roccati Pass across end of first lake north of the pass

Phot. E. H. Armitage

Mount Enitn from Cavalli Pass

Phot. G. N. Humphreys

Bridge made by fallen trunk across cascade in gorge

Phot. E. A. Armitage

The lake just south of Roccati Pass with wild duck

experienced in Fort Portal, where there are definite wet and dry seasons. From the total experience of all expeditions to the range it would appear that although spells of clear weather may occur in any month there is no time of the year when they should be expected.

Glacial action is traceable in the valleys many miles below the present level of snow, and the diminution of the glaciers would appear still to persist. Cairns built by the Italian expedition are covered with lichen of growth subsequent to their erection, but at a much lower level rocks *in situ* just below the glaciers are entirely devoid of vegetation. Many of the lakes would appear to be receding. The omukoni tree will grow in swamp but not in standing water, however shallow. Large areas in the valleys are dotted with omukoni trees all young, while at a slightly higher level the trees are of all ages.

With the development of Toro and increased transport facilities expeditions to the range are likely to be more frequent, and observations on climatic changes should prove of great interest.

Before the paper the PRESIDENT (Dr. D. G. HOGARTH) said: This Society has often heard about Ruwenzori. The close connection of Mr. Douglas Freshfield, Mr. Mumm, and Dr. Wollaston with this Society has secured that. It has also heard an account of the explorations of the Duke of the Abruzzi. But it has not heard anything, I think, for about twenty years, and therefore special interest attaches to the fact that we are going to have to-night an account from, I think, the only traveller who has ascended all the peaks, more or less—I am not sure whether I am correct in saying that he has ascended them all. We may regard to-night as the crown and summit of a long series of explorations of those misty Mountains of the Moon, the mere existence of which was for so long doubted. Captain Humphreys, who is about to address you, is an adventurous person, who flew before the War, flew in the War, was then penned in a German prison for something like four years, and then, when the War was over, took up survey work in Uganda. It was while he was engaged in this survey work that he made the very thorough exploration of the Ruwenzori range, which he is about to describe to you. He has, I believe, left the Uganda service, but not without having added a very distinct contribution to our previous knowledge of Central Africa. I will now ask him to address you.

Captain Humphreys then read the paper printed above, and a discussion followed.

Mr. DOUGLAS FRESHFIELD: The region we have heard of to-night, one of the most remote on the world's surface, the inmost heart of Africa, is from many points of view of extraordinary interest to other than mountain explorers. Our attention was first called to its scenery by Sir Harry Johnston, who, unfortunately, is not well enough to be here to-night. His beautiful book certainly was the one that first drew me to think of going to Ruwenzori. The region has a political importance, since it lies on the frontier of Uganda and the Congo State. In 1894 the statesmen of the two countries confessed their lack of knowledge of the local togography of this part of Africa by taking the 30th meridian east of Greenwich as the boundary between the two States. Later on they found that the 30th meridian was wrongly placed on the maps they used; that it lay considerably further east. The result was to give the

Phot. E. A. Armitage

The lake just south of Roccati Pass with wild duck

Phot. G. N. Humphreys

Bridge made by fallen trunk across cascade in gorge

whole of Ruwenzori and the Edward Lake to the Belgians, which had not been at all their intention. So a compromise was made by which the crest of the mountains was recognized as the boundary. This arrangement has not been without its inconvenience. It has had an unfortunate effect, particularly to explorers of Ruwenzori. I do not know how things may be now. I am told that the population has been shifting backwards and forwards, the natives alternately trying British and Belgian control, and coming on the whole to the conclusion that they prefer British. Twenty years ago the tribes on the west flank of the range did not receive strangers gladly, as Dr. Stuhlman and Mr. Wollaston both found out. Consequently, there still remains a field for detailed exploration on the western flank of the range; the valleys that slope towards the Semliki river.

As to the higher region, the Duke of the Abruzzi's wonderful expedition has narrowed the unknown, though he did not altogether cover the field, as you have learned from the very interesting lecture we have had to-night. The Duke explored the eastern glens, and climbed, one after the other, the snowy summits. I am afraid I can add very little to what you have heard to-night from Captain Humphreys, or what some of you heard twenty years ago at the memorable meeting in the Queen's Hall at which the Duke read his paper and King Edward himself took the chair—the only time, I believe, when our Sovereign has taken the chair at a Geographical Society's meeting.

My own visit to Ruwenzori with Mr. Mumm and a Zermatt guide was in the year before the Duke's: that is to say, in 1905. In choosing the time of year I acted on the advice of the friend whom I had every reason to believe would know best—Sir Harry Johnston. Unluckily, he did not realize that the climates of Entebbe and Ruwenzori are distinct. It was not until after our arrival at Fort Portal that we learned from the missionaries and the native headmen there that in Toro mid-winter and midsummer are the best seasons for the mountains. I advised the Duke to this effect, and he took my advice; and I think on the whole the result proved that it was not bad advice. I have been at the pains to analyze his Table of Ascents. Ruwenzori is, of course, always a desperately bad place for weather, but between June 19 and 28 nine days out of eleven were fine enough for snow climbs. In the first eleven days of July the Duke's party climbed on seven! That surely is not a bad record for Ruwenzori. If you want further proof that the time of year was fairly favourable, you can see it in the wonderful series of photographic panoramas and views taken by my friend Vittorio Sella, the prince of mountain photographers, some of which you have been shown to-night. Yet I can honestly say I do not regret our own bad luck, for had we succeeded the Italians would never have started for the Equator, and we should not have had Sella's photographs.

Of the picturesque features of Ruwenzori it would be easy to talk for the rest of the evening, but I shall confine myself to a very few sentences. Let us begin at the top—the region above the snow-level, above 15,000 feet. The summits, despite their nearly 17,000 feet, do not vie as a rule in boldness of form with those of the Alps or the Caucasus. They are moderate and for the most part dome-shaped protuberances crowned by glaciers which are in the nature of ice-caps rather than ice-streams; what in the Alps are called "Secondary Glaciers." But the snow region of Ruwenzori has one singular feature, of which you have seen a beautiful specimen—those fairy-like grottoes, with their pendant icicles and crystal columns which support broad cornices projecting like eaves from the ridges of the loftiest peaks of Mount Stanley.

It is of the middle region of the mountains between 8000 and 15,000 feet that I should like, if I had the power, to give you some of my impressions. They are amongst the most vivid of a lifetime of travel. That enchanted forest has a weird and grotesque effect that is all its own. In the mists and gloom of the frequent rainstorms it may suggest a nightmare caused by studying the illustrations of Palæolithic vegetation in some text-book. In the rare sunshine one may fancy oneself enveloped in the scenery of a Russian pantomime. The open glades bristle with the upright stalks of lobelias, green obelisks 12 feet high, like tombstones in a Turkish cemetery. They are mixed with senecios, writhing stems, crowned by mops of spiky leaves, fit for a witch's broom. High up a white everlasting Helichrysum covers acres with a sheet of its silver or golden blossoms. On the precipitous slopes and ledges tree heaths drip with the perpetual moisture. Gaunt and grey, draped in preposterous masses of moss and lichen, they look like the vegetable ghosts of a departed world.

You may be familiar with the Alps and the Caucasus, the Himalaya, and the Rockies, but if you have not explored Ruwenzori you have still something wonderful to see and do. Our last view of the range was the strangest of all. It was from its foot, at sunrise. Our porters called us out of our tents by their shouts to witness the wonderful spectacle. The whole range, not only the snows, but also the dark Portal peaks and the wooded heights, was immersed in a deep blood-red glow. Tennyson's line, "God made Himself an awful rose of dawn," seems best to express the strange vision.

Mr. E. H. ARMITAGE: I have very little excuse to be here, because I am no biologist, or zoologist, or anything like that. But your Secretary said I must stand up and let myself be seen. There will be some who envy me for having been in the Ruwenzori Range, and there will be others who will say, "Well, poor fool!" Anyhow, both sorts may like to look at me. Still, there are one or two things that I should like to say, though there is very little that I can add to Captain Humphreys' most excellent paper, if I might say so, describing our journeys. One thing that stands out vividly in my memory is one day when we were on the Stanley plateau at the foot of Alexandra Peak. There was just a clear moment between the drift of the mist, and we saw down into the Belgian Congo. I suppose it must have been 12,000 or 13,000 feet below, and we could almost pick out where the vegetation changed—where there was forest and where there was grass; and we could see the remarkable Semliki winding below. That does stand out most in my mind: standing at the top and just thinking of the people below in the sun—very hot, very uncomfortable, I expect, and we were standing out, very cold and also rather uncomfortable. There are definite periods, of course, down below of dry and wet weather, but whether that has anything to do with the climate at the foot of the snow is very hard to say. The rivers flow down into the Semliki on the western side and down into Lake George on the eastern; surely, you may say, you will be able to tell from the spate there whether it is wet or dry up above. But I do not think that is true, because we noticed on a very wet day the rivers were swollen in the evening from the rain, one presumes, and on a very fine day they were also swollen from the melting of the snow in the sun. So, to my mind, the storms up above have very little to do with the storms below, and at any time of the year up above is as good as any other time. But, on the other hand, getting up there you do meet rivers swollen by water which has been collected on the lower foothills.

Colonel E. M. JACK: Some years ago Captain Humphreys and I occupied

adjoining stools in the Geographical Section of the War Office. He was occupied in making air maps, and I was occupied in making maps of another description. It is a great pleasure to meet him again to-night and to hear his account of a phase in the new life which he has been following since that time. It is, almost to a day, twenty years since I reached the neighbourhood of the country Captain Humphreys has been describing to you to-night. I went out as a member of the Boundary Commission, in command of Colonel Bright, which was sent to map the country along the 30th meridian, as Mr. Freshfield told you, with the object of settling the question of how geography lay in that part. On that Commission and in the year that followed, when I took a share in carrying out the geodetic survey of the 30th meridian arc, I travelled up and down the eastern side of Ruwenzori a good many times, and made a circuit of the mountain and ascended to several points on it. We had no time on that expedition to do any mountaineering; our job was simply to map the country. I have not, therefore, the intimate knowledge of the higher peaks that Captain Humphreys has; I can speak only from the surveyor's point of view. My business, as the officer in charge of triangulation, was to fix the positions and heights of as many features of geographical interest as I could, and I was naturally very anxious to fix the peaks of Ruwenzori. I was very favourably situated for that purpose, occupying high ground all round the mountain. And yet I found it a most extraordinarily difficult task. The difficulties were two-fold. First of all, in the dry season, the fog in that country is so thick that you do not see the mountain at all. We found that in the height of the fog which covered the country in the dry season we could not see beacons which were 4 or 5 miles away; they were quite invisible. The whole mountain at that period is entirely invisible, and we know the classic example of that is the fact that Stanley in 1874 was near the mountain for a long time and did not even know of its existence, and it was not till fourteen years later, in 1888, that he first saw it. I took every opportunity I could of observing the peaks, and I do not think I missed any opportunities. I developed the art of tumbling out of bed and getting my theodolite up and adjusting it to a really high degree of perfection; and, in spite of that, I only got seven observations to the summit, seven independent observations from four stations: so that shows that it is rather a difficult object to see. In the dry weather the fog is the difficulty; and in the wet weather, when the air is ordinarily clear, the summit is usually hidden by clouds. The only time I found you could see the summit was just before sunrise. As soon as the sun warms the air the clouds rise and hide the peaks altogether. I only saw the mountain clear once. That was on our homeward journey, when we were a long way off, and by that time all the instruments had been packed and sent away.

Captain Humphreys spoke about his being the first party that had crossed the range. I do not know exactly what the technical meaning of crossing a range is, and I feel I have to be rather careful with members of the Alpine Club sitting just in front of me. But I should like to mention the fact that Corporal Thomas on our expedition crossed the mountain from west to east, reaching a height just under the snow-line of about 14,000 feet, carrying out his mapping the whole way. That may not be technically crossing the mountain, because of course he did not cross the summit, but I think it is worth mentioning.

Just one other point. I think, Sir, it is an honourable tradition amongst those who speak after these lectures to disagree with something the lecturer has said, and I propose to honour that tradition. Captain Humphreys has

constantly used the expression "Ruwenzori Range." Now years ago, when we had just come back from that country, and we were often talking about Ruwenzori and that very remarkable series of volcanoes away to the south, I commented on the curious perversity, as I think it, with which people would describe Ruwenzori as a "range," while they talked of the volcanoes, which consist of some eight entirely separate and distinct peaks, as "Mount Mfumbiro." Ruwenzori appeared to me to be a mountain pure and simple. It is one long ridge about 70 miles in length, and rising to one culminating group of summits, and I cannot understand why people call it a range; it seems to me to be essentially a single mountain. That may not appear to be a very important point, but as a Fellow of the Royal Geographical Society, I am a stickler for accurate geographical description. With that exception, I would like to congratulate the lecturer very much indeed on his paper, which I found extraordinarily interesting. He did not dwell on his difficulties very much, but he must have had very great discomforts and difficulties, which required a large amount of courage and determination to overcome.

The PRESIDENT: Would Mr. Mumm care to say anything? He was one of the earlier climbers who saw Ruwenzori.

Mr. A. L. MUMM: I am very glad to have this opportunity of congratulating the reader of the paper on his most interesting discourse and his equally interesting slides, which carried me back to what was my first experience of travel off the beaten track. I have only very few remarks to make, and the first one is this: He began his paper at Fort Portal; any account of our expedition would have had a chapter, as the Duke of Abruzzi's expedition had a chapter, on the journey from Kampala to Fort Portal. Captain Humphreys probably accomplished that journey in two days in a car. I believe you can do it, if you make a long day of it, in one. It shows how things change in twenty years. It took us a fortnight, and during twelve of those days I do not think we had a single decent drink of water. That impressed itself on me very much. It was my first experience, as I say, of rough travel.

Going to Ruwenzori itself, the other thing that struck me was that I did not gather from the narrative at what moment in their progress the party got from the Mobuku Valley into the Bujuku Valley, though the latter was found by the Duke of Abruzzi to be the key to the exploration of the range. By the way, I think "the Ruwenzori range" is undoubtedly the proper geographical description. We walked past the junction of the two valleys without being aware that there was any Bujuku Valley or Bujuku River at all; and I think I am right in saying that it was the Duke of Abruzzi's expedition which discovered it for the first time. The consequence of that was that we arrived at the head of the Mobuku Valley amongst some minor peaks, and that of all the mountains we have been introduced to this evening we never saw one, except once or twice at great distances when we were not on the Ruwenzori Range at all. I think that is rather an interesting illustration of the gradual way that geographical knowledge grows. We walked past the mouth of the Bujuku Valley, just in the same sort of way that people until a very few years ago, on Victoria Nyanza, went past the mouth of the Kavirondo gulf without knowing it was there; or, to come to a more modern instance, just as the first Mount Everest Expedition went by the mouth of the East Rongbuk Glacier Valley without knowing it was there.

The PRESIDENT: Is Canon Fisher here? I think he has lived round about Ruwenzori a long time, engaged in missionary work.

The Rev. Canon A. B. FISHER: It is nearly thirty-four years since I first

saw Ruwenzori. I have followed with intense interest the different expeditions to that mountain, and I think we have been listening this evening to a most modest account of one of the greatest achievements in the exploration of Ruwenzori. It was about 6 March 1893 that I got my first view of the great mountain. I remember a Uganda chief, as he pointed in its direction with a wave of his hand, saying "Gamalaga gafumba biri," which in our language meant, "The great leaf in which the clouds are boiled." I found amongst the Bakonjo, as well as the Baamba, who live along the slopes, that this was a name for the mountain very well known to them; and, after a residence of more than nine years in that district, I can quite understand how that proverb came into use. It is most fascinating to live there for any length of time, all the year round, and to see the atmospheric changes and the behaviour of that tropical mountain. Sometimes you see incessant electric currents passing into the top of it. Again, you see all the clouds in the rainy season for 100 miles round or more literally being dragged down, coming at different paces, and when they get to the centre of the mountain they steady, and then in half an hour or more there are astounding thunder concussions, and the rain falls all over the country with tremendous force. Or, on the other hand, different clouds may be thrown down from the top of the mountain, and steady themselves sometimes, and form out along the slopes; and then, when the sun comes out brilliantly after a storm, you see the ridges of the great mountain illuminated behind four or five different-coloured clouds. While acting as chaplain to Bishop Tucker, the great apostle to the Baganda—who was, by the way, an artist and a member of an artist family, and had his pictures hung in the Academy before he became a clergyman or a bishop—I can remember how fascinated he was with the aerial effects and atmospheric conditions upon the mountain.

I ascended, in 1903, with my wife—who is, I think, the only lady who has got up to the glaciers. I was the leader of the expedition; the other member was the present Bishop of the Upper Nile, Bishop Kitching. I am not at all surprised that Captain Humphreys found it difficult to get the natives to go on from different altitudes; my surprise is that he got them to go at all, because of their desperate superstition. They are animists of the most primitive type, and all these great forces in Nature are worshipped by them or propitiated in the most gruesome manner. Thunder and lightning, the rocks and the trees, the torrential rains, the force of the rivers, and everything like that, are awe-inspiring to every single member of the Bakonjo tribe.

When I wrote home soon after our expedition to Ruwenzori and told my friends that I had seen the stuff they feed their canaries on growing from 25 to 30 feet high, blackberries as big as my fist, and heather from 25 to 30 feet high, they of course said, "Oh, well, he has written from the centre of Africa, and he is an Irishman!"

I can understand a remark made here this evening by, I think, our veteran explorer, whom I remember very well coming to Toro soon after I had left—Mr. Freshfield. He said, "You may have seen a European glacier, but an African glacier is a very different thing indeed." It is indeed. You look at a great glacier and ice-fields shining in the tropical sun. It stands out like a magnificent silver shield, and seems to glint and throw out colours with an iridescence indescribable. The difficulty of climbing these peaks has been put in altogether too modest a way to-night. I have never listened to a more modest lecturer in my life.

The PRESIDENT: Previous speakers have said most that I wished to say.

I was as impressed as they have been by the extraordinary amount which Captain Humphreys left out; that is to say, all the struggle and the toil which brought him to the points from which his photographs were taken. I felt that there was a very long story of endurance and very grim determination behind the taking of a great many of those views. I ask you, with the utmost confidence, to give him your thanks. I have a good long experience of public meetings, and I know perfectly well that you have been interested. I will ask you to express in the heartiest possible way your thanks to Captain Humphreys for a very remarkable lecture and a series of very remarkable pictures, and for an altogether exceptional self-effacement.

Note on the Nomenclature of Ruwenzori, by the Editor, G.T.

The nomenclature of the Ruwenzori Group is the last conspicuous example of the practice which was once commended, but is now happily avoided, of affixing European names to geographical features in Asia and Africa. It is of course true that one can rarely obtain genuine native names for peaks and glaciers of a mountain group even if there is a name for the whole massif. It is equally true that for description one must have names for individual features, and the difficulty is to give names to such features which shall have at any rate the appearance of belonging to the region. Sir Halford Mackinder when he climbed Mount Kenya had the happy idea of giving to the two peaks the names of legendary Masai chiefs and heroes. The Mount Everest Expedition when they were on the ground adopted English descriptive names which were after translated into Tibetan, and those appeared upon the maps.

The present nomenclature of Ruwenzori is due to the Duke of the Abruzzi, who after his successful exploration of the range consulted Doctor Stuhlmann, Sir Harry Johnston, and others, and with careful consideration gave the names of the famous early explorers of Africa to the groups, and to the peaks the names of Members of the Royal Houses of Italy and Great Britain, the names of previous explorers of the range, and of members of his own expedition. We have therefore on the map a mixture of several categories of European names for the peaks and glaciers, and native names for the rivers. With all respect to the rights of the illustrious traveller whose expedition made so complete a conquest of the peaks and study of the range, we feel that it would be a great advantage if after the most friendly discussion it were possible to agree upon euphonious names of native appearance for the peaks and glaciers, before the present exotic names have become irreplaceably established. With the intention therefore of leaving this possibility open we have on the accompanying map retained the six names of the six snow-clad groups, including of course the eminent name which the then President of this Society very naturally, after the Duke's paper, insisted should appear conspicuously upon the map; but the names of the individual peaks are given in a list and identified by their spot heights. This may be held to have the double advantage that the topography of the range is not obscured by a large number of names, and the possibility of reconsidering those names is tentatively suggested.

THE TWO OLDEST MAPS OF CHINA EXTANT

The Reverend W. E. Soothill, Professor of Chinese in the University of Oxford

Read at the Afternoon Meeting of the Society, 14 March 1927.

IT is in tribute to the memory of two friends, both great authorities on the geography of China, as well as in the interest of the subject itself, that I have undertaken to deliver this lecture. Sir Alexander Hosie, in years gone by so esteemed a contributor to the work of this Society, had happily completed his admirable Map of China, showing the commercial products of the country, of which a copy is in the collection of the Society. No sooner had he completed this very complicated and valuable work than he yielded to the persuasions of Col. Dudley Mills to study the two maps which are the subject of this paper, and before his death he had written a part of this lecture. The second great authority is M. Edouard Chavannes, whom I had the pleasure of entertaining in T'ai-yuan-fu, when he was on his archæological exploration. His lamented death deprived the world of an exact and brilliant Sinologist. He had already published an exhaustive article on the two maps in the *Bulletin de l'École Française de l'Extrême Orient* (Avril–Juin 1903). I have myself carefully studied that article and compared it with rubbings I obtained through the kindness of the Rev. J. Watson of Hsi-an-fu, Shensi, before the late prolonged siege of that city. I have also compared it with treatises in Chinese and with Playfair's 'Cities and Towns of China,' and should like to add my tribute of high regard for M. Chavannes' usual carefulness and thoroughness. If I differ from him in certain particulars it will be with head still bowed in respect. As his article was published nearly a quarter of a century ago, and is now hardly available, even to a French reader, it seems advisable that the two maps should be discussed in English.

The following is Sir Alexander Hosie's introduction to the subject, written in August 1924:

> The Chinese have for many centuries made maps of their own country. It would seem as though cartography were an instinct implanted in every nation with any claim to civilization. At the very time that the Romans were engaged on making maps of the whole of their Known World, Chinese were, in all probability, occupied with the same task—a task which, considering the area of China and her boundaries and the number of cities involved, was no mean one, as I myself, who have been recently engaged on the same duty, can amply testify. In a review of my map, I was interested to read this comment: "China takes great credit to herself for her age-long 'civilization,' her ancient learning, and the scholastic attainments of her literati, but with it all such a mundane necessity as cartography appears to have been entirely overlooked." As a matter of actual fact, China has, in the course of the centuries, been entirely and completely mapped in detail by the Chinese,

although of course not scientifically, since they were unaware that the Earth was round. Indeed, in the archives of every city in China there are carefully preserved maps for the use of the magistrate of the administrative area concerned. These are often beautifully executed, astonishingly accurate, although perhaps containing a wealth of detail that appears to us irrelevant. Nor do these maps remain unused, as I discovered in a discussion on the matter with the magistrate of Tsangwu on the West River, the district city within the administrative area of which lies the city and open port of Wuchow. In fact, he kindly presented me with a printed copy of the history of the place, illustrated with maps. Chinese officials were frequently moved about from one city to another, and doubtless found these maps of great benefit in their work.

The two most ancient maps of China known to exist were discovered in the Forest of Tablets at Hsianfu, the capital of Shensi province, in the far interior, their existence being made known to the Western world by Monsieur Edouard Chavannes, formerly Professor of Chinese at the Collège de France. They are graven on stone slabs set up in this "forest," which is a collection of most valuable and ancient monuments gathered together in that city. These slabs, with innumerable other stone tablets on which are cut, amongst other works, the Thirteen Classics or Canonical Works, including the Nine Classics of the T'ang Dynasty (618–907), with similar records of antiquity, specimens of calligraphy and portraiture, are stored in a series of low buildings known as the Pei Lin, or Forest of Stone Tablets. The Pei Lin is now, as I saw when in Hsianfu, the home of the famous Nestorian Tablet. This, after being buried for many centuries, was erected about a mile outside the west gate of Hsianfu; and from this spot was removed again when an enterprising foreigner roused suspicion in the Chinese mind by causing a replica of it to be made, which was intended for America, but is now deposited in Rome. The Chinese feared the original was to be removed, and the replica substituted; for the tablet, like the others in the Pei Lin, looks as fresh to-day as if it had just been cut, and it would be hard to distinguish between them.

Through the offices of a French father, M. Chavannes was able to secure rubbings of the treasures of the Pei Lin, and, amongst others, of two stone-engraved maps. M. Chavannes, the most distinguished Sinologue of modern times, whose industry, acumen, and scientific zeal were beyond admiration, published a most informative and instructive exposition on the main features of these two maps. As, however, Chavannes, to the great regret of all who knew his work, has died, and his brochure can be obtained only from Hanoi in Tonquin, I may perhaps be pardoned if, together with my own observations, I recapitulate some of Chavannes' findings.

These two maps, the most ancient in existence in China, as far as is known, have the year of their engraving cut on the stone, the year called Fou Ch'ang, which M. Chavannes reckons as 1137. But the first reference to a map of China made in Chinese records is found in the work of the great Chinese historian, Ssŭ Ma Ch'ien—partly translated by Chavannes—who relates that, in 227 B.C., the Prince of the state of Yen, fearing the territorial ambitions of Prince Cheng, of the state of Ch'in, later known as Shih Huang Ti, or "First Emperor," sent his heir presumptive to the court of the latter with the avowed object of presenting a Map of the District of Tu Kang, which was to be handed to Prince Cheng. The real object, however, was the assassination of the Prince; for the map, which was carved on wood, was packed in a box, and when Prince Cheng drew it out, a poisoned dagger lay behind, which the

emissary essayed to use. The plot failed, however, and the would-be assassin was arrested.

During the civil war which followed soon after the death in 210 of the "First Emperor," his capital at Hsien-yang, in Shensi, was sacked by the Prince of Han, and maps were discovered there.

There is ample evidence in the histories of the two Han dynasties, the Former Han and Later Han, to show that, in addition to wood, silk was used for writing and for map-making. During the Later Han paper was invented in A.D. 105 by a chamberlain of the Emperor Ho Ti, named Ts'ai Lun, an invention which proved an excellent substitute for cumbersome wood and expensive silk. But there can be no doubt that all these maps were rude drawings intended for military, administrative, or engineering purposes, and, to judge from later maps, had no pretence to scientific accuracy.

Passing over the epoch of the Three Kingdoms, we come to the Western Chin or Tsin Dynasty (A.D. 265–317). Its first emperor, Wu Ti (A.D. 265–290), appointed a very remarkable man, P'ei Hsiu (224–271), Minister of Works in 267. P'ei Hsiu may be justly entitled the Father of Chinese Cartography. He studied all existing topographical matter and maps, and constructed a new map in eighteen sheets, which the Emperor deposited amongst his secret archives. To this map, which was on the scale of 500 *li* to 1 inch, P'ei Hsiu added a Preface in which he laid down his valuable Six Principles of Cartography. (They are given later.) His six principles were undoubtedly a very great contribution to cartography.

Notwithstanding the invention of paper, map-carving in wood was not extinct; for, in the Annals of the Liu-Sung Dynasty (420–473), it is related that one Hsieh Chuang (421–466) carved a map in wood, 10 feet square, showing mountains, rivers, and the general configuration of the country. This map consisted of detachable pieces which could be removed and put together again.

The T'ang Dynasty (618–907), one of the most renowned in Chinese history, pursued a policy of conquest in the west and south, and in its annals frequent mention is made of Treatises on Geography with maps of conquered western territories. Such maps were made by Hsu Ching Tsung in 658 and Wang Ming Yüan in 661, while in the reign of Hsüan Tsung (742–756) Wang Chang Ssu, in obedience to the emperor's commands, constructed a map showing the frontiers of the foreign countries bordering on China.

In 785 Chia Tan, a famous cartographer of the T'ang Dynasty and a worthy successor to P'ei Hsiu, received the imperial commands to construct and present a map of the whole of China. Ill health prevented him from carrying out these commands until 801; but in the meantime he was able to prepare a map of the country, including Kansu and part of Szechwan, which had been occupied for some years by Tibetans, and from which they had lately been dislodged by Chinese armies. In 801, however, at last his masterpiece was produced. It was entitled "Map of China and Foreign Countries Within the Seas." The Chinese character which I have translated "foreign" is literally "barbarian," and was officially applied to Europeans along with other non-Chinese nations when they first came into contact with China. This map, which was on the scale of 100 *li* to the inch, measured 33 by 30 feet, and must have covered a much greater area than what is known to us as China of to-day. No doubt it included the bordering countries which paid China tribute.

Li Chi Fu (758–814) was another celebrated cartographer of the T'ang

Dynasty. He constructed a map for the Emperor Hsien Tsung (806–821) showing the strategic points north of the Yangtse, and he was the author of a work entitled 'Map of the Regions and Kingdoms during the reign of Yuan Ho.' This work was divided into fifty-four books, in which were described the important towns in the Empire, mountains, rivers, and the general lie of the country; and the description of each district was prefaced by a map.

When the Emperor Hsien Tsung, in 821, gave his daughter in marriage to the Chief of the Ouigars, one Yüan Chen, in order to console the mind of his sovereign with regard to the long journey which the Princess had to undertake, prepared what was evidently a route map from the then capital Ch'angan, now Hsianfu, in Shensi, to the Ouigars' encampment in the north. He marked the various stages where the Princess would eat and sleep and the general configuration of the country.

Following the T'ang came the Five Dynasties, which lasted for only fifty-four years, when they gave place to the Sung (960–1126) and the Southern Sung (1127–1278). In the histories of these two latter dynasties frequent reference is made to maps by such cartographers as Sheng Tu, who presented the Emperor Chen Tsung (998–1022) with maps which he made of the regions to the west of the present province of Kansu; and Shen Kuo (1030–1093), who was the first to produce a Relief Map, namely of the frontier districts which he visited. This map had a wooden foundation on which mountains, rivers, and roads were shown by a paste of flour and sawdust. These substances, however, did not withstand frost and crumbled away in winter, necessitating the substitution of wax, which was lighter and more portable. Shen Kuo himself describes the construction of this relief map, and tells the following story about map-making. When a Korean embassy was bringing the customary tribute to the Chinese Emperor Chen Tsung (1068–1078), the members of the embassy requested and obtained from the authorities *en route* maps of the country through which they were passing. The Prefect of Yang, who thought this very suspicious, under pretence of complying with their request, asked them instead to allow him the use of theirs that he might take copies. When he once had them in his hands, however, he burnt the whole collection and reported his action to the Emperor! The dread of map-making is not yet dead in China. In 1910, when I was inspecting the cultivation of opium in the northern provinces, one of the first questions put by the Viceroy at Lanchow in Kansu to the Chinese deputy who accompanied me, and whom he received privately, was, so the deputy told me afterwards, whether I was making maps of the country.

The fact that the Korean mission was collecting maps of the country shows that map-making, which had hitherto been confined almost entirely to production for Imperial use and that mainly for purposes of warfare, was becoming more common under the Sung Dynasty. Previous to this, maps made for the emperors were stored in their palaces, and as these were sacked during wars and rebellions, there is little wonder that no trace of their existence remains to-day. For of all the above-mentioned maps, not one is known to be in existence at the present time. The two earliest existing ones are those described by Chavannes and graven on stones, now in the Forest of Tablets in Hsianfu, in the twelfth century, although it is evident that both these maps must contain much material handed down from older specimens.

The first thing that must strike the most casual observer is the general truthfulness of these two maps. When one considers the size of the country, which is almost as large as Europe, and its miserable means of transport,

one stands amazed at the accuracy of those cartographers of the twelfth century. The characters also, which are wonderfully clear, bear no trace of archaism. The Tribute of Yü, Map B, in addition to the advantages of its squares, is more trustworthy with regard to the sea-coast, and its presentation of the Shantung promontory is notably more accurate than in Map A; but Map A is possibly its superior in dealing with the waterways and river systems, and shows mountain ranges, besides including the Great Wall. The lines in Map B are not, of course, for latitude or longitude, but for distance, each square representing 100 square *li*.

Now these engraved maps being evidently copies of older specimens, the question arises: What were the dates of the originals from which they were copied? Chavannes, by dint of sifting internal evidence, came to the conclusion very convincingly that the original of Map A, the map without the squares, was drawn somewhere between 1043 and 1048, *i.e.* towards the middle of the eleventh century. The fact that there is another stone tablet at Chinkiang, brought to his attention by M. P. Pelliot, on which is engraved the selfsame map, but at a little later date than the one in the Forest of Tablets, seems to confirm his conclusion. Chavannes even says that the map was originally drawn by a geographer who was a subject of the Liao throne during the eleventh century A.D. He could find no internal evidence in Map B, however, which gave him a clue to the date of the original from which it was drawn, and it is, therefore, with Map B that I shall deal in the main.

It has been the custom in China on the fall of a dynasty to change or modify many of the place-names, and even to change not a few during the course of a dynasty. For example, when the present Republic succeeded the Manchu dynasty, scores of place-names were either completely changed or so modified as to necessitate the compilation of a new map to bring the geography of China up to date. It is, moreover, extraordinary to find how soon the new names entirely oust the old in many cases. In 1919, only eight years after the establishment of the Republic, I had occasion to visit a place called Lai yüan Hsien, on the borders of Chihli and Shansi. Though this is a Hsien city, the residence of a stipendiary magistrate, I could find no trace of it on any map, until I was informed by a Chinese gentleman that its name till 1912 had, under the Manchus, been Kwang chang Hsien, and as such it was easily found on the maps. When I reached the city neighbourhood, I found the new name in common use and the old one practically forgotten. In the same way, foreigners in China knew very well the name of Honanfu, a city in Honan province. This was changed in 1912 to its old name of Loyang, a city now famous as the seat of Marshal Wu Pei Fu, and the name Honanfu, except to foreigners, is obsolete.

When, therefore, one examines an old map of China, the place-names thereon should indicate the dynasty in which it was compiled, while if the date when the map was engraved is also given, as in both these cases, there should be clear evidence that the names were antecedent to that date. This may seem a truism; but one can never jump to conclusions in things Chinese, for it often happens, as it has happened in a number of instances in the present republican nomenclature, for example, Loyang itself, that the old names are revived after many centuries.

Map B, as engraved on its stone, measures 31 inches from north to south, and 30 inches from east to west, and the two maps are much the same size. It is divided into squares bounded by seventy perpendicular, and seventy-three horizontal, lines. At the top it is entitled in bold characters:

MAP OF THE FOOTSTEPS OF YÜ ; 100 li to the Square.
Names of the Mountains and Rivers in the Tribute of Yü.
Past and Present Names of Provinces and Departments ;
Past and Present Names of Mountains, Rivers and Lands.
Cut in stone in the fourth moon of the seventh year of
Fou Ch'ang (*i.e.* A.D. 1137).

The title of this map requires explanation. In the year B.C. 2297, during the reign of Yao, the Kingdom of China, which then consisted of parts of the modern provinces of Shensi, Shansi, Honan, and Shantung, and with its capital at Yanghsia in Honan, was visited by a great flood caused by the overflow of the Yellow River, so well and deservedly known as China's Sorrow. This particular flood, so it is said, was almost on a level with the tops of the mountains, and the greatest difficulty was experienced in draining off its waters. Emperor Yao, on the advice of Shun, who later became his associate in the government and still later his successor, called in a young man named Yü, who, after eight or nine years of unremitting toil, succeeded in regulating the rivers and digging canals, and thus clearing the country of water The story runs that so earnestly did he wrestle with the waters that, though he frequently passed the door of his home on his work and could hear his young son cry, he never saw him till his duty was accomplished. As a reward Yü was granted a small state in Honan called Hsia, and Shun designated him as his successor to the throne. On the death of Shun, Yü established the first Chinese dynasty and named it the Hsia in B.C. 2205, and is himself known in Chinese history as Ta Yü, or the Great Yü. The Yü Kung, generally translated the Tribute of Yü, which forms part of the Chinese classic, the Shu King, describes the work of Yü in draining the flood, the wide territory through which he passed, and the tribute each region had to offer. Our map is therefore styled " The Footsteps of Yü."

On examination, this Map B, which is so far as at present known the earliest extant map of China, having been engraven some six months before Map A, shows that the information contained in it is not confined to that given in the classic work, "The Tribute of Yü." Compared with present-day maps of China its general configuration of the coast-line, the courses of the rivers and their tributaries, and the positions of the cities or districts are remarkably approximate. On occasion the author of either this or the original, has been misled by the maps from which he copied. Thus, the Yellow River, which is accurate enough at its two bends, is made to enter the Gulf of Chihli at about where Tientsin stands now, the copyist's eye having evidently been caught by the trend of the Tientsin River. In the same way, there is confusion of the lakes and waterways towards the mouth of the Yangtze.

The names in both the original maps are, of course, cut in Chinese characters. I have been at some pains to transliterate these into our Western script in order to make the maps intelligible to those unacquainted with Chinese, and in order also to render it easier to compare them with our own European maps, which in spite of inaccuracies, must be, owing to our more scientific methods, our criterion for the geography of China. But once again, pitfalls may entrap the unwary. I am not at all sure, for instance, that the makers of either map have meant to indicate the exact location of any city or town. The city of Chungking (Yü on maps A and B) is itself on the very bank of the Yangtze, and the city of Canton (Kuang) lies spread over its river's banks. In both the maps these " cities " are given a little inland : so that it would seem as if possibly the cartographers were occupying themselves rather with administra-

tive areas than the exact location of walled cities, a supposition which is borne out by the fact that maps were peculiarly for administrative and military use. Moreover, when examining the history of these city names, as given by Playfair in his 'Cities and Towns of China,' and comparing them with these on our maps, it is often exceedingly difficult to disentangle adjacent administrative areas.

Map B has none of the notes around its borders found on Map A. These notes refer to the "foreign countries" included under the heading of the latter map, and these are not included under the heading of "The Tribute of Yü." None of the outside countries actually figures on Map A, except a portion of Korea, and many of the notes are historical as well as geographical. Some are merely concerned with the names of warring and troublesome tribes to the north of the Great Wall, but others refer to the great journeys undertaken by Chinese generals and embassies in the past, to conquests made *en route* and tribute gathered—journeys as far as the Persian Gulf and the Oxus. One note speaks of the country of the Brahmins, "which covers an area of thirty thousand *li* and possesses cities by hundreds." Such notes give us some idea of what was the Known World of the Chinese at that date, besides quickening our admiration for the intrepidity of those early travellers. Modern Chinese maps, in the same way, often have on their borders names of countries and peoples who once, possibly centuries ago, paid tribute to China. It is reported that the Chinese map of China hanging to-day in the Peking office of General Feng Yu Hsiang, the "Christian general," still contains Burma as part of China. And it must not be forgotten that Burma paid tribute to China for some years even after our occupation. One note refers to the Great Yü. It says: "When Yü separated the nine provinces, at the east he gradually arrived at the sea; to the west he reached the moving sands"—a striking phrase very descriptive of the condition of things in Central Asia.

It would be beyond the bounds of an article in this *Journal* to take each of the places on the maps and compare its name and position with those on a modern map. This is a task which may interest some future geographer of China. My intention is . . .

Thus ends Sir Alexander Hosie's article, and what his "intention" was we need not discuss, for intentions do not always tally with conclusions. I purpose instead to refer again very briefly to the history of Chinese cartography without, I hope, undue repetition of what he has written, and then to consider more in detail both of the maps, especially with regard to their origin and period.

The history of cartography in China is made the more difficult because the character 圖, *t'u*, connotes a good deal more than a "map." To-day it means "a plan" and "to plan," a drawing, diagram, map. Whether originally it meant anything of the kind it is impossible to say. As an official record it may perhaps have meant merely a table, or schedule. The *Chou Li* tells us that a Chief Controller (*Ta ssŭ tŭ*) had in his charge the *t'u* of the empire's territory, from which there was knowledge of all the lands of the nine divisions with their extent, east and west, north and south; the mountains, forests, rivers, and so on were differentiated, as also the States, political divisions, and individual estates. But it is doubtful if the *Chou Li*, as we have it, existed before

the first century of our era, and, apart from the unreliability of this record, its description does not help us to prove that the various *t'u* over which this official and his clerks had charge were maps and plans in our sense of these terms.

The *Shan-hai-ching*, or Classic of the Mountains and Seas, is spoken of by one Chinese writer as a kind of map. It is really a book of marvels attributed to the Chou period, B.C. 1122–255, but, as it stands, is of comparative late date. The book, *inter alia*, speaks of the variety of tribute depicted on the nine metal tripods of the Emperor Yü, B.C. 2205. Because of this statement and of the extraordinary animals mentioned in the book, this writer would have us believe that it is the source and origin of European cartography, for as our early maps are ornamented with strange animals, the idea must have been transmitted to the West by the Arabs; ergo, Western cartography arose from so fanciful a book as the *Shan-hai-ching*.

The first mention of a *t'u* which may perhaps be called a map, or diagram, is that which was presented by Ching K'o in B.C. 227 to the Prince of Ts'in when he availed himself of his gift to attempt the murder of the prince. That prince, the self-styled "First Emperor," after crushing his rivals and unifying the State, collected all the *t'u* of the various States in his capital. Twenty years later, B.C. 207, when his successor was overthrown, the Han Minister Hsiao Ho, while all the attacking generals ran off to pillage, himself sought the inner precincts of the palace and collected the ordinances and regulations, the *t'u* and the records, all of which were the keys of government. From these *t'u* the new ruler of the Han dynasty, B.C. 206–A.D. 221, learned the passes, the census by hearths (or families) and by individuals, the strategic places and the localities where the people were in difficulties. These *t'u*, engraved on wood, existed till the end of the first century A.D. Chavannes thinks they described only a limited territory, and that they were of the nature of topographical plans, or panoramic views. He does not consider that we have any evidence of the existence at that time of any map of the whole empire. This is a view in which I am inclined to concur, notwithstanding that the empire then was a comparatively small affair.

Returning to B.C. 128, we find that after the return to China of Chang Ch'ien, China's first historic traveller or explorer to the Oxus, the then Han emperor, generally known as Wu Ti, for the first time fixed the name of that famous range of mountains, north-west of the empire, known since his day as the K'un-lun. He gave it the name of K'un-lun, because ancient records had said that the River, *i.e.* the Yellow River, took its rise in marvellous mountains of that name, and Chang Ch'ien described its source as being there in Yarkand and Khotan. It was in 117 B.C., under the same Emperor Wu, that a *yü-shih*, a censor, or high officer, offered him a *Yü Ti T'u*, a term which will challenge criticism if I translate it by "Map of the Vehicle-land." Here we have the first reference

to this term *Yü Ti T'u*, and *Yü Ti* has become the general name for Geography. Now *Yü* means "the body of a cart," and by metonymy "a cart," or "vehicle," and one is led to raise the question: Was this earliest known *Yü Ti T'u* a route map, or a journal of the routes or roadways which vehicles could travel? I can give no definite answer to this question, but it is reasonable to assume that some, if not all, ancient Chinese maps were route maps, and that the Chinese term I am discussing may be indicative of this meaning.

In B.C. 99 the *t'u* sent by General Li Ling to his emperor showed the line of his long march against the Hsiung-nu or Huns, from Lake Sogok in Mongolia to the mountain 浚稽, Chün-chi (or Hsün-chi). He indicated the mountains, watercourses, and configuration of the places passed. In A.D. 26 we read of the Emperor Kuang Wu making use of a *t'u*. As to a *Yü Kung T'u*, a title similar to that of our map B, the first mention of such a map was in A.D. 69, when Ming Ti, the then ruler, commissioned Wang Ching to repair a breach in the Yellow River, China's perpetual sorrow. He gave him, among other things, a "Map of the Tribute of Yü," the famous reducer of China's historic Flood. This is the first mention we have of a map of all China, and it could only represent a part of the present-day area. A modern Chinese writer assumes from this reference that his country then without doubt possessed complete maps of China and the surrounding States, and he deplores the fact that no description whatever of them or of their character remains. Chavannes also considers that these first-century *t'u* were veritable maps, certain of them representing the whole empire, but he adds that there is no proof they were constructed according to a rigorous method. I see no reason to doubt that they were maps, whose simplicity and crudeness are later attested by P'ei Hsiu of the third century A.D.

There seems to me, therefore, little doubt that charts, or route maps, were in existence some time before our era, for nothing is more natural, even among people who are ignorant of maps, than the indication by stones or twigs of relative distance and of the curves and angles of the road. Among the Chinese, a people with a system of writing at that time still nearer the pictorial stage than now, it would be the most natural thing to indicate routes, including mountains and rivers and even boundaries, in chart fashion. But this is only the embryonic stage of cartography. The real advance begins when configuration, orientation, and distances are described with initial accuracy. While I see no reason to doubt that the *Yü Kung T'u* of A.D. 69 was a genuine map, however crude, of all the then known China, yet it seems clear that the stage when configuration, orientation, and distances were shown was only reached in the third century A.D.

Then arose P'ei Hsiu, the father of cartography in China. Born in A.D. 224, serving under two dynasties, dying at forty-eight years of age, he produced a map in eighteen sections, which was received by the

emperor and placed in the secret archives of the palace. Of this map no known trace remains. It may be taken for granted that he built upon the foundation of progressive predecessors, of whom, beyond those already named, we have no mention. But P'ei Hsiu made the first known scientific contribution to cartography in China. His map in eighteen sections is known as "The Map of the Territory of the Tribute of Yü." In his preface he says: "Cartography (literally, drawing and writing) has come down to us from the past. From of old men have set up pictographs and transmitted models and have relied on their utility. The three dynasties (Hsia, Shêng, and Chou, *i.e.* down to B.C. 255) appointed for them officers, imperial writers (or historians) holding these appointments. When the slaughter by the Han troops took place in Hsien-yang the chief minister, Hsiao Ho, obtained possession of all the maps and records of (the overthrown dynasty of) Ts'in. But now there are no longer any ancient geographical maps, and none of those obtained by Hsiao Ho, but only a mixed lot of general and local maps of the Han period. None of these shows *fên lü* (which temporarily your lecturer will call distances), nor indicate correct orientation; they are incomplete in their record of the famous mountains and great rivers, and though they have a rough configuration they are all imperfect and unreliable; moreover, they use words of wild exaggeration and distortion, inconsistent with facts and unacceptable to common sense." After encomiums to the emperor, he goes on to attribute to him the demand for correct maps of his new territories. All existing maps proving unreliable, P'ei Hsiu says that he proceeded to a study of the geographical descriptions found in the "Tribute of Yü" of the mountains, seas, and watercourses, the highlands, lowlands, slopes and fens, also the nine ancient divisions and the present sixteen divisions, the boundaries and outlying districts of their provinces, states, prefectures, and towns, together with the old names of the places where the ancient states made their treaties or held their assemblies, as well as the various routes by water and by land, and (thus) he made his geographical map in eighteen sections.

Then he lays down his six rules for cartography, which are excellent for the period in which he lived.

1. *Fên lü*, 分率. This is a term already mentioned, and which I shall discuss more in detail presently. Here I will follow Chavannes and style it "rectilinear divisions," and assume for the moment that they were squares on the "grid" principle, "by which," as P'ei Hsiu says, "to define relative location, east and west, north and south."

2. *Chun Wang*, 準望. Orientation, "so as to show correctly the relation of this (place) to that."

3. *Tao li*, 道里. Mileage, or route miles, is the definition I am accepting, but the term might mean "stages." His definition helps us little—"that by which the reckoning of what has been passed may be fixed."

4. *Kao hsia*, 高下. Altitudes, "the high and the low."

5. *Fang hsieh*, 方邪. Right and oblique angles, or bends (in the route).

6. *Yü chih*, 迂直. The curving and the straight.

He goes on to say that the three last show the lie of the land, by which comparison may be made of the ease or difficulty (of the route). On maps without rectilinear division he says there is no means of discovering distance. With such lines, but without correct orientation, though one attains it in one quarter one loses it in another. With orientation, but without "mileage," or "stages," then, commissioned to places cut off from each other by mountain or sea, one could not reach them, etc.

It is P'ei Hsiu who deservedly has the credit of carrying the work of his predecessors up to a scientific standard. If he indeed invented the "grid," as seems probable, then he antedated by centuries the work of the author of our map B, on "The Tribute of Yü." In order to enable you to form an opinion on this interesting question of the invention of the "grid" map, and perhaps add another to the valuable discoveries made by ancient Chinese, let me present such evidence as I have been able to procure, with apologies for its technicality.

There are two terms which require consideration. One is 分率, given by Chavannes as *fên lü*. The other is 廣輪之度, *kuang lun chih tu*, which four characters are P'ei Hsiu's own definition of *fên lü*. First discussing this definition, which Chavannes translates as "the dimensions of the superficies," its literal form is "the degrees of *kuang-lun*," or of the *kuang* and the *lun*. Now what is the meaning of these two words? or what was the meaning? K'ang-hsi's dictionary defines *kuang*, whose normal meaning is "breadth," as, in cartography, "from east to west"; and *lun*, whose normal meaning is "a wheel," or "to revolve," as "from north to south." If these definitions be accepted the meaning would be "degrees (or measurements) east and west, north and south." These "degrees" are of course not meridians, or lines of latitude and longitude in the spherical sense, for they are equal in both directions on the Chinese basis of a flat, four-square world. A difficulty arises as to the correctness of the interpretation of *lun*, which would naturally suggest either the periphery of a map, or the lines of a vehicular route. But if this interpretation were accepted, the "grid" theory would be upset, for the meaning of *fên lü* would then be the distances on the superficies and on the periphery, or on the routes and rivers. The route-distances seem to be indicated in the third law of *tao li*, or "route mileage," if we take *li* to mean miles, and not "places," or "stages," which it does equally mean. In any circumstances our map B has to be accounted for, so that on the whole I am inclined to accept the Chinese definition of *kuang lun* as indicating the lines of the "grid," east and west, north and south. In that case Chavannes' hesitant definition of *fên lü* as "les divisions rectilignes" would be confirmed.

As to the term *fên*, it means "to divide," or "division"; but what is the second character? Should it be pronounced normally as *shuai*, or abnormally as *lü*? If we consider the character in its original form it will appear to throw an interesting light on the question of the "grid." According to Chinese authorities the original form of the character was entirely pictorial. It represented a large-meshed hand-net for catching birds, the strokes protruding at the bottom and the top representing the handle of the net, and the rest the frame and mesh. Here, then, we have a term "net" ("mesh" having already been appropriated) better even than "grid," and if I venture to refer to map B as the "net" map you will understand my reason for so doing. The only difficulty I have is found in the pronunciation of the character. It has two sounds, its normal sound of *shuai*, which probably approximates to its early sound; the other is the sound accepted by Chavannes of *lü*, which is used with the meaning of 約數, defining quantity. I have not been able to make inquiry of any competent Chinese, who would probably be just as dependent on books and tradition as the rest of us. If P'ei Hsiu's pronunciation of the word were *lü* then it might possibly, though not necessarily, tear larger holes in my "bird-net" theory.

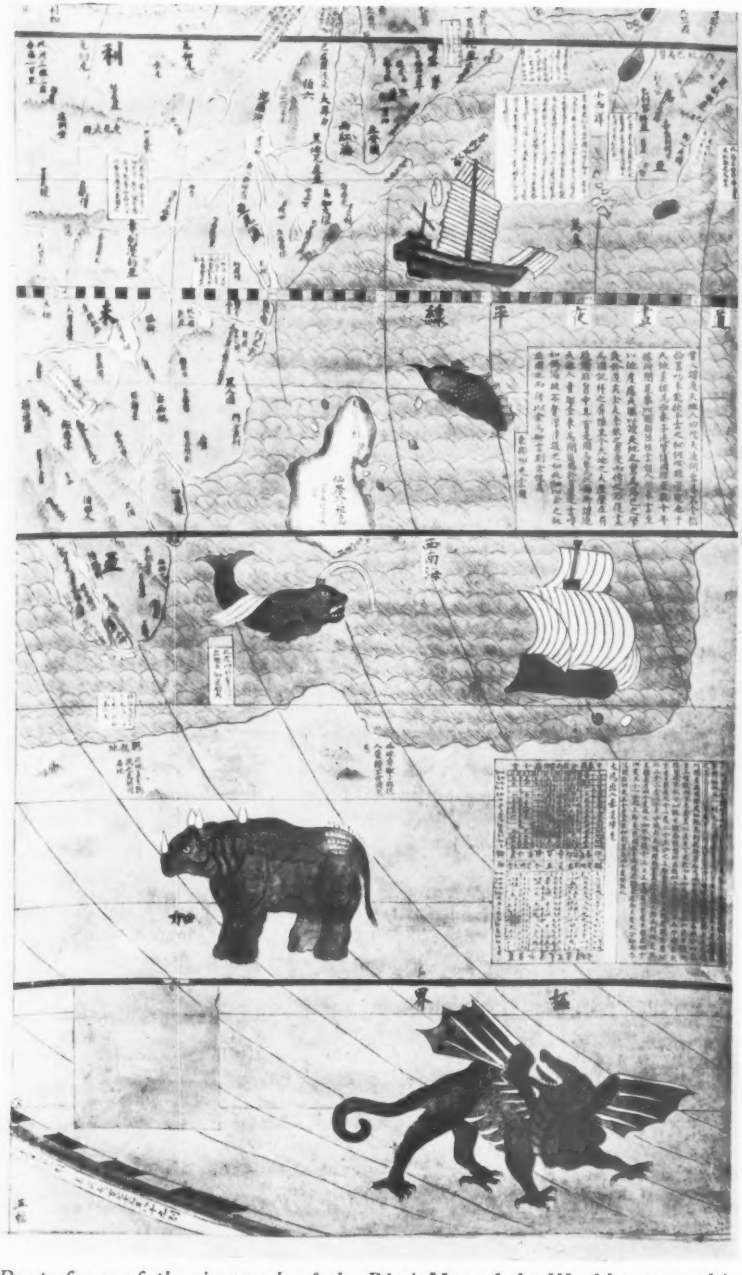
As to the "net," I have already stated that meridians in our sense of the term are not thus indicated, for the indication of meridians of the sphere was unknown in China until Matteo Ricci made his map of the world in Chinese in A.D. 1602. That was the first introduction of spherical projection, but despite Ricci's endeavour his spherical world failed to be adopted and remained unacknowledged by the Chinese down to our own day. They have done remarkable work in many directions, but though there has never been actual arrest in progress, yet in cartography, as in most of the other branches of scientific knowledge, they have still to attain to first rank. They have had no Pythagoras, no Thales, Anaximander, Hecatæus, Pytheas, Eratosthenes, Strabo, or Ptolemy—all of them long before the days of P'ei Hsiu. Nearly three centuries after Ricci the world was still to the Chinese a four-square plane—not even a disc. Seeing, however, that it took a thousand years for Europe to accept the spherical shape of the Earth and to overcome its belief in geocentricity, one need not be unduly surprised at China.

Returning to P'ei Hsiu, we are told by Ch'üan Tsu-wang, *circa* 1736 A.D., that P'ei Hsiu's map was on the scale of 2 inches to 1000 *li*; a *li* is roughly a third of a mile. The source of his information, however, cannot be traced. After P'ei Hsiu, one Hsieh Chuang, 421–466, carved a map on wood 10 feet square. This could be taken to pieces, like a jig-saw puzzle, so that the provinces might be studied separately. In 658 Hsü Ching-tsung, and in 661 Wang Ming-yüan, supplied maps of the western areas, which had been added to the empire after the T'ang emperor had overcome the Turks, territories which stretched from

Tarbagatai to the Indus. A century later, 742–755, Wang Chung-ssŭ supplied a map of the western regions, showing distances.

None of these maps exists to-day, and Chinese cartography remains with us, thanks almost entirely to the labours of Chia Tan, the famous cartographer of the T'ang dynasty, who lived from A.D. 730–805. It was in 801, when over seventy years of age, that he presented to the throne his *Hai-nei Hua Yi T'u*, or Map of China and Barbary within the (four) Seas. This map was 33 feet high by 30 feet wide, and on the scale of 100 li to the inch. So large a map would therefore describe an area in English miles of about 11,000 miles from north to south and 10,000 miles from east to west. So great an expanse of territory was one about which the Chinese could have, for by far the greater half, but the haziest notion, for it covers nearly half of the globe. Chia Tan is said to have gathered most of his information in regard to foreign countries from tribute bearers and visitors to the capital, so that the map seems to have depended largely on "travellers' tales." His original map is no longer in existence, nor do any copies of the whole exist. I am, however, going to suggest a theory of my own for the consideration especially of Chinese geographers. My suggestion falls into two parts: (1) That our present map A of China and Barbary is in fact that section of Chia Tan's original map which depicted China; and (2) that his map of Barbary, now lost, is represented by the descriptive details written around the map. Chavannes, taking Chia Tan's original scale of 100 li to the inch and applying it to our map A, says our map covers a space of 7300 li north to south and 7000 li east to west. Apparently he has measured the whole stone for these figures, or accepted the squares on the net map. In point of fact, the actual territory shown on map A covers less than 5000 li from north to south and less than 6000 from east to west. In neither of the two maps are the geographical distances accurate, but generally excessive. From this one may discover confirmation of the fact that cartography had no astronomical basis, but was wholly pedestrian.

The date of our map A, China and Barbary, in its present form—that is, as it came from its latest editor—can be fairly accurately known from its own written statements. For instance, it describes the Khitan nation as the 大遼國, *Ta Liao Kuo*, or nation of the Great Liao. The word "Great" clearly indicates that the latest editor lived in that part of Northern China which had been conquered by the Khitans. Chavannes gives exhaustive evidence in favour of the year 1043 as that in which "the author of the map" made it, or, as I prefer to think, revised it and perhaps added the notes. It seems evident that its original was known while the Sung dynasty ruled over the north, that is, before the northern invasion of the Khitans, for the dates given are those of the Sung dynasty, *e.g. Chien-lung* 960–2, *Ch'ien-tê* 963–7, *K'ai-pao* 968–75, *Tuan-kung* 988–9, and last of all the sixth year of *Pao-yüan* 1043. In point of fact, the *Pao-yüan* sixth year never existed, for that period



Part of one of the six panels of the Ricci Map of the World preserved in the Museum of the Imperial Palace at Peking: from a photograph of the whole presented to Professor Soothill, now shown in the Museum of the R.G.S.

beginning in 1038 ended in the following year 1039, but our editor, living in the north-west under the recent conquerors, the Khitans, was unaware that the Sung dynasty had in 1040 changed the *Pao-yüan* period to *K'ang-ting;* he therefore carried *Pao-yüan* forward to the sixth year, that is, 1043. Chavannes gives detailed arguments in justification for fixing 1043 as the date of map A, and though I willingly accept them, I am by no means willing to admit that they fix the date of the map itself, apart from its descriptive matter. How to get back to the original map is the difficulty.

On first studying these maps the line of inquiry which suggested itself as the most suitable for settling the dates of their compilation seemed to present itself in the names of the districts shown on them. And the reason for this consideration was the sweeping alteration in place-names which usually occurs on a change of dynasty. I think there is evidence in the place-names on the map A to justify the dating of it during the T'ang dynasty; in other words, about the period of Chia Tan. But I am not quite confident of this line of proof. In Ricci's map, for instance, we have an interesting instance of the way in which a map can remain essentially the same map in almost everything but a slight alteration of the dynastic title.

This is well shown by the Ricci map. It is with much pleasure that I am able to show photographs of what I take to be the original of Ricci's great map of 1602, made 900 years after Chia Tan's famous Map of China and Barbary. These photographs were presented to me in Peking last year, and this is the first time that they have been seen in this country, or, so far as I know, anywhere outside China. Ricci's map was offered to the emperor towards the end of the Ming dynasty. You will see that it very clearly bears the characters 大明, *Ta Ming*, Great Ming, the name of the then existing dynasty. It was afterwards engraved on wood blocks, without the embellishments of ships and beasts, and a copy in the Society's collection was thought to be of the original edition, until it was found to bear the words 大清, *Ta Ch'ing, i.e.* the Manchu dynasty, which came into existence in 1644 and ended in 1912. Those who desire to know more fully the contents of the map will find them in the *Journal* of October 1917, where Mr. Baddeley and Mr. Heawood have discussed the subject, and in the issues of December 1918 and January 1919, where Dr. Lionel Giles translates the text.

Returning to our two so-called "Chia Tan maps," it is tempting to say offhand that the map A, of China and Barbary, though carved on stone later than the net map, yet is decidedly the older of the two, for it is inconceivable that any cartographer with the net map available would have neglected to correct the coast-line. The net map shows not only the Shantung promontory, which is hardly noted on map A, but also, with the exception of the Chekiang coast, which I happen to know better than any other, it shows the coast-line with far more approximation

to reality than does map A. It is, however, noteworthy that the river system in this, the China and Barbary map, so far as the west is concerned, is superior to that in the net map. Map A also shows the mountain ranges, which are totally absent from the net map. I shall endeavour to account for this omission later, as in my opinion the net map was produced for a purpose quite different from that of Map A.

Referring again to the river systems shown in both maps, it will be noted that in the net map the only south-western river shown is a river marked "Black River Mouth." The Black River joins the Red River near Hanoi, the two having run parallel for about an equal length. But, out of position though it is, Chavannes notes this is the exact location it occupies in the chapters on "The Tribute of Yü." If the theory I shall propound is correct, there is every reason for the river system in the west and the Great Wall in the north being ignored in the net map and receiving much more detailed treatment in the map of China and Barbary. In the west of the latter map is a rough designation of what seem to be the Mekong, Salween, Irawaddy, and perhaps the Ganges rivers. In the north-west also the general detail is greater than in the net map.

It seems to me certain that though these two maps are nowadays attributed to Chia Tan, he cannot have been the cartographer of both. They present all the appearance of having been made by different cartographers at different times, in different localities, and for different reasons. I suggest, therefore, that Map A, China and Barbary, is part of Chia Tan's map completed in A.D. 801, and that it may have been based on P'ei Hsiu's maps of the third century, not directly, but rather on copies which the elaboration of numerous local cartographers, especially towards the west, had made possible; of the existence of these during the T'ang dynasty, 618–907, we have abundant records. I would further support my theory with the evidence which the map gives, as already mentioned, of the importance of the west and north-west. The stress laid upon those regions in Map A seems to be entirely in accordance with their political predominance during the T'ang and pre-T'ang periods, when the coast was far from the capital and of minor importance to the Government. That the north-east should be more fully developed in the net map may be accounted for on similar grounds, inasmuch as the political pressure of the north-east was predominant at a later period. These grounds would, I consider, be sufficient to adjudge the map of China and Barbary as the older map, and therefore the most ancient map of China now extant.

I am inclined to go further and say that not only have we here the China section of his China and Barbary, but that the cartographical representation of Barbary, being of comparatively minor value, has disappeared, leaving only that portion, namely China, which was of special interest to the Chinese. As already stated, Chia Tan had built his map of Barbary on descriptions he received from tribute bearers

and other foreign visitors to the capital, as also from the records of Buddhist pilgrims and other travellers, and therefore, the part relating to Barbary must necessarily have been, for the most part, of a fanciful character. All that is left, therefore, of Chia Tan's Barbary may be the written description of it inscribed around the section of China which, if my surmise is correct, still remains to us. If it were possible to reconstruct Chia Tan's Barbary from that description it would perhaps give us a map of the world as conceived by him in the eighth century.

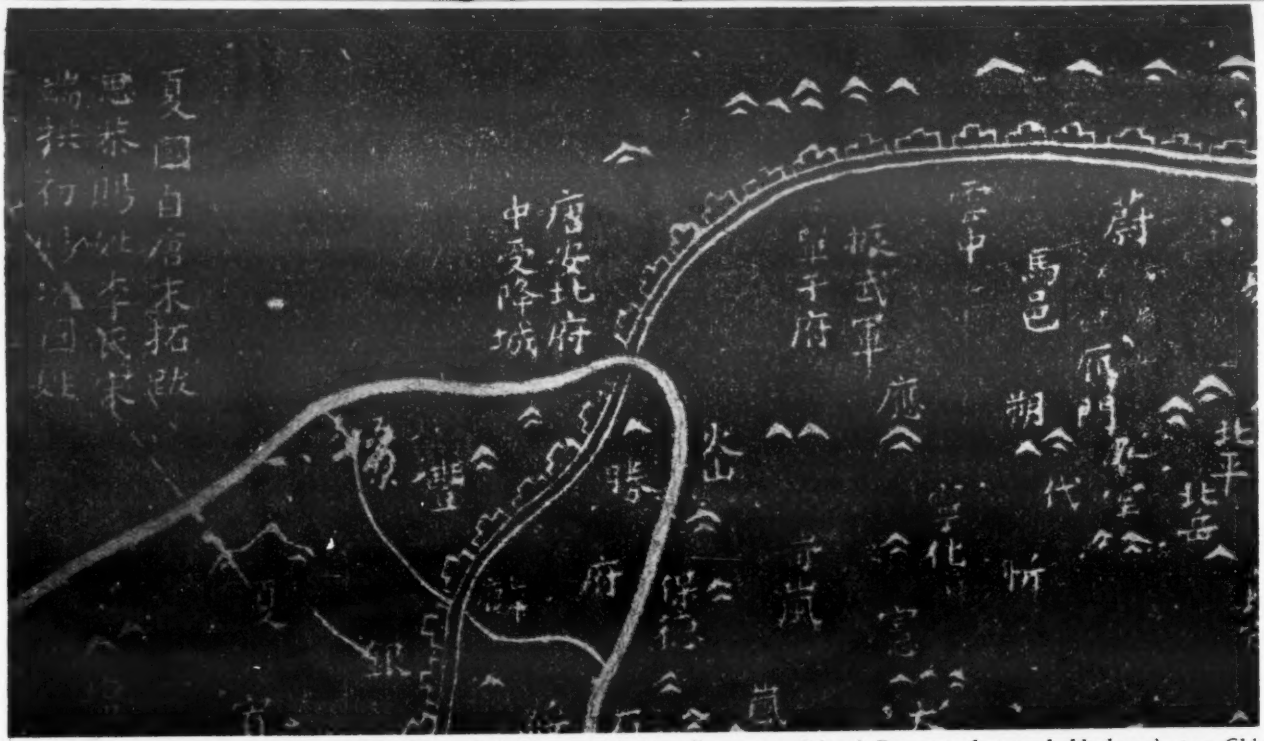
But there are other reasons to account for the disappearance of the Barbary section of the map. First, there were the chaotic internal conditions which resulted from the fall of the T'ang dynasty in 907, and the sixty years or more of civil strife which followed. Again, Chinese political interest was swung from the west and north-west to the east and north-east by the rise of the Khitans and their invasion and conquest of North China. I therefore consider that map A, with possible change of some names, is China as it was known in the eighth century A.D. May I in passing draw attention to the mountain ranges in that map? These ranges are represented with reasonable accuracy, and I think the reason is that they are an essential feature of any map that is required for military and political purposes. It is noticeable that these ranges are not shown on map B, for a reason which I shall now place before you.

Let us turn to an examination of map B, "Map of the Footsteps of Yü." Its title and sub-titles show clearly that it is a map drawn to delineate the territories which paid tribute to the Emperor Yü, the reputed founder in B.C. 2205 of the first Chinese dynasty. The Tribute, or Tributaries, of Yü is the title of one of the chapters of the *Shu Ching*, or "The Book," a work whose authenticity is doubted, but which, at least as early as the first century of our era, was accepted as a genuine record of the pre-Confucian period. At any rate it existed long before the days of P'ei Hsiu, and undoubtedly gave the title to his famous map. It certainly existed for a thousand years before the net map B, and was one of the most important text-books used in higher education and in the public examinations. The importance of this point to our consideration of map B is manifest, inasmuch as the *Yü Kung*, or Yü's Tribute, forms the chief geographical part of the *Shu Ching*. As already stated, before Yü became emperor he had subdued the historic Chinese Flood, and is reputed to have travelled far and wide in China for this purpose. It is quite possible to interpret the title of our map as "The Footsteps or Trail of Yü," that is as found in the "Tribute of Yü," but it probably indicates the tracing of the boundaries of Yü's tributaries. The Tribute of Yü tells us that, having brought the indigenous tribes into subjection, he divided the whole of his territory into nine provinces. fixed the tribute each province was to supply, and set up in his palace nine tripods, one for each province, covered with graphic indications.

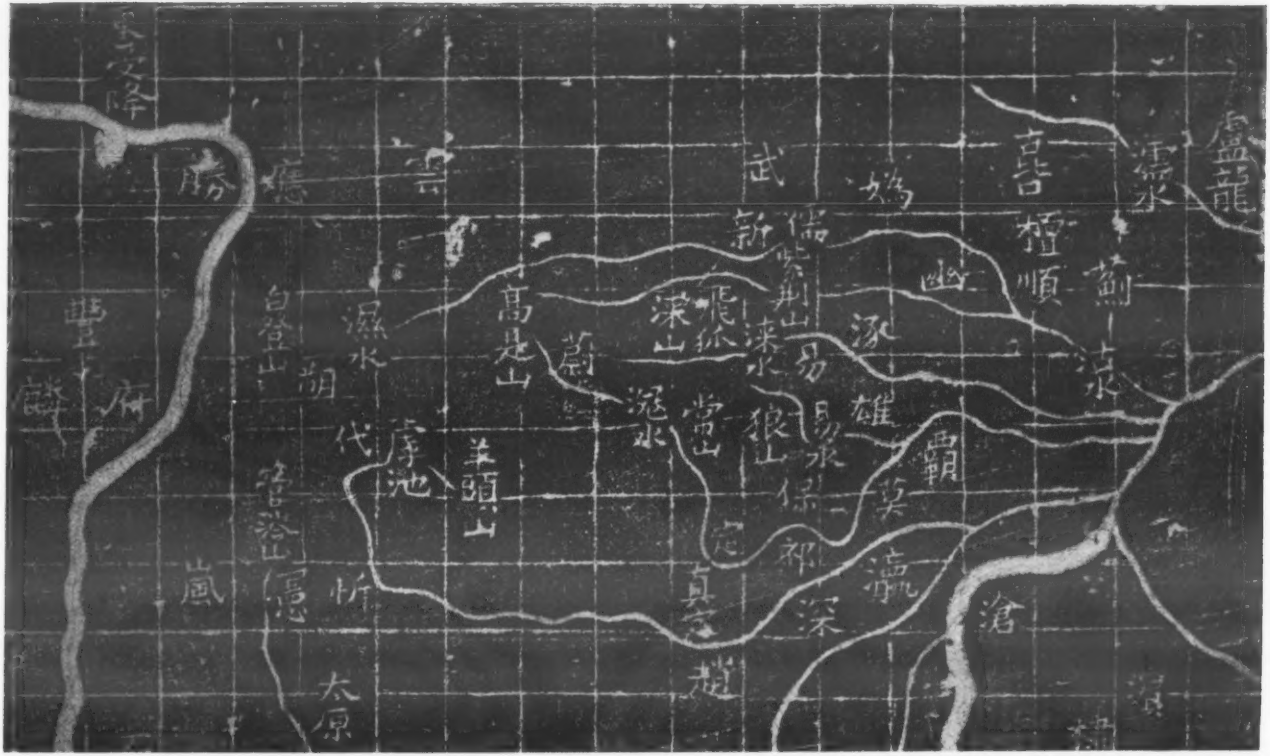
Our map B therefore might be styled a map of the tributary provinces

of the Emperor Yü. This seems to me to account for the absence of the Great Wall, which of course did not exist in Yü's day; as also for the indifferent treatment of the then little-known far west and the still less known south-west. How then does it happen that the Shantung promontory, the east and north, and the coast-line receive so much more attention in this map? My reply is that the map was made after the political orientation had changed from north-west to north-east. It was certainly not the result of a new national survey, but an attempt by some northern cartographer to correct the outline of existing maps of China, aided no doubt by increase of local interest in topography, especially on the part of official administrators. The history of China clearly shows that the Khitans, or Tungus (Tung-hu, or Hsien-pei), had drawn political attention to the north-east. True they were troublesome as early as the seventh century, and continued their profitable raids from time to time, but at that period they were a nuisance rather than a political menace. It was only after they had settled in the Liao-tung Peninsula that they became an aggressive factor. The end of the tenth century saw the serious struggle begin between the native Sung dynasty and the Khitans of the north-east, a struggle which continued with bitterness and huge territorial loss to the Chinese dynasty until the rise of the relatives and former dependants of the Khitans, namely the Kins. In 1125, under Akuta, the Kins overcame the Khitans, proceeded to invade China, and by 1127 had mastered most of China north of the Yangtsze, and driven the Sung rulers over that river, which they never again effectively crossed, for during the following, the thirteenth, century the conquering Mongols destroyed both Kin and Sung and conquered all China, as also most of Asia.

It was early in the Kin rule, or rather in that of a Chinese king reigning by their appointment and subject to them, that our two maps were carved on stone. Map A was carved, according to its own statement, in the fourth month of 1137, in the official college at Ch'i-shan in Fêng-hsiang-fu, 120 miles west of Hsi-an, the provincial capital of Shensi. As to Map B, whose date of engraving is six months earlier, Chavannes reasonably surmises that it was engraved in the same college. Now it is my opinion that this Map B of the Tributaries of Yü was made and used entirely for pedagogical purposes, its object being solely to enable students preparing for examination to visualize and understand the geography of the chapter on this subject in the Classic of Ancient History. Nor do I depend for this opinion on a mere surmise that the stone was carved in the college at Ch'i-shan. We have further confirmation in Chinkiang, the Guardian of the Yangtsze's mouth, where a stone map of exactly the same dimensions as that of our map B was made in 1142, not by an ordinary administrative official, but by the Prefectural Director of Studies. This map was not, however, made from our map B, but from a common original. At any rate, its being carved by the Director of Studies lends



A portion (full size) of Map A, "The Map of China and Barbary," engraved in A.D. 1137, but probably based upon Chia Tan's map of A.D. 801. From a rubbing of the engraved stone tablet at Hsianfu, measuring 30½ inches square. The plate shows the Great Wall crossing the Hwang Ho below Paotehchow



A portion (full size) of Map B (the net map) :—" The Map of the footsteps (or tribute) of Yü " cut in the seventh year of Fou Ch'ang (A.D. 1137), but probably based on a reconstruction of P'ei Hsiu's map made A.D. 800–1100. From a rubbing of the engraved stone tablet at Hsianfu, measuring 30½ × 31 inches. The plate shows country between the bend

colour to my suggestion that the map was for educational and not for administrative or military purposes. Further confirmation may be adduced from the contents of the map itself, for instance, the placing of the Black Water River as the only one in the south-west, which, as Chavannes indicates, is exactly the place where it is shown in the chapter on the Tribute of Yü. If, then, my conviction that map A of China and Barbary is much the older, then its more extensive representation of the western river system, as also of the Great Wall and other features, cannot have been unknown to the maker of map B, but I consider that he deliberately limited himself to his historical subject, while using all the increase in cartographical knowledge which had taken place eastwards since the days of map A. I may add that map A, with its wealth of historical detail, was also undoubtedly engraved, in its present form, for educational purposes in Chinese history, but this in no way invalidates my theory as to its real origin.

A question which puzzles me is: If the *fên lü*, or *fên shuai*, that is, the mesh lines of P'ei Hsiu on his third-century map of the Tribute of Yü, were really drawn 1000 li to the 2-inch square, how is it we do not find similar squares on what I am calling Chia Tan's map A, while we do find them 100 li to the inch on map B of Yü's Footsteps? Now there can be no doubt that our net map is the oldest existing map with a grid in China, perhaps in the world. Is it possible that it is P'ei Hsiu's third-century map of The Tribute of Yü, or at any rate based on his map, reduced in size and corrected according to later research; or is it a more or less original map founded on tradition, or on records and on the rules laid down by him? It must always be borne in mind that we have no reliable evidence of the scale of P'ei Hsiu's map, for the only known witness is Ch'üan Tsu-wang of the eighteenth century, 1500 years later. At any rate we have here two maps, known by titles already existing. Map A is engraved with the name given by Chia Tan to his great "Map of China and Barbary," and I suggest that our map is the section of his map which related to China, the Barbary portion, by an irony of fate, for it was Chia Tan's chief interest, having been reduced from his cartographical to a mere written description. I do not accept the view of certain Chinese writers that his map has been shrunk to a tenth of its original size, but rather that the main part is lost. His map was made definitely for political and military purposes, and it is not impossible that in map A we have the drawing and scale of the China section as he produced it. As to the map B, it has a similar title to that of P'ei Hsiu of the third century A.D. Now we are told that P'ei Hsiu's map had disappeared long before Chia Tan's day. It is therefore practically certain that this map is not P'ei Hsiu's. Again, as already stated, it is extremely unlikely that Chia Tan drew maps so different in configuration as maps A and B. I am, therefore, far more inclined to think that map B was drawn by an unknown cartographer on P'ei Hsiu's

A portion (the net map) of Map B of the Footsteps (or tribute) of Yü cut in the seventh year of Fou Ch'ang (A.D. 1137), but probably based on a reconstruction of P'ei Hsiu's map made A.D. 800–1100. From a rubbing of the engraved stone tablet at Hsianfu, measuring 30½ × 31 inches. The plate shows country between the bend

net system, sometime during the three hundred years which elapsed between Chia Tan's death and A.D. 1100. It seems apparent that it was an endeavour, seven hundred years later, to reconstruct P'ei Hsiu's map, or rather to construct an up-to-date map on his principles, and for a similar purpose, that is to say, to illuminate the reputed ancient *Shu Ching*, or Classic of History.

One is tempted to think that Chia Tan's work stimulated such an interest in cartography that the Provincial officers, not least the coast officials, began to make maps of their provinces, and even to reproduce them, for block printing began at least as early as the tenth century. At any rate, we have clear evidence that cartography received much attention, especially during the T'ang period 618–907. And it may be taken for granted that no one cartographer, or company of cartographers, at any one period had surveyed and mapped the whole coast, or any other part of China. What may be justly assumed is that from P'ei Hsiu's day onward crude maps were from time to time produced, especially where political or military exigencies required them. Nor is this mere speculation, for we have it on record that numerous maps were made even before the T'ang dynasty, namely between 300 and 600 A.D., which are said to have disappeared during civil war. Such total disappearance is doubtful, for under the short-lived Sui dynasty, 589–618, we have a note of the existence of old local maps, undoubtedly genuine maps; and under the succeeding T'ang dynasty 618–907, the titles of many others are given. I again draw attention to this fact and make the inference that our two maps of China were synthetic productions of two separate individuals who had other maps at their disposal. I believe, therefore, that map A is Chia Tan's; map B the product of a later unknown cartographer who adopted P'ei Hsiu's principles, but with configuration corrected by knowledge acquired after Chia Tan's date 802.

In conclusion, let me say that the general ignorance of the history of Chinese cartography is seen by the fact that Père Richard's standard work on the Geography of China makes no reference to the subject, or any mention whatever either of the name of P'ei Hsiu, or of that of Chia Tan. As to that useful work the *Encyclopædia Sinica*, it dismisses the whole subject with the words: "The Chinese map is crude and incorrect. China itself is drawn of a shape to suit the map, the provincial boundaries are most roughly given, mountains and rivers seem added from fancy." Neither of these works is twenty years old. But I think you will agree with me that there was as much cause for pride in the production of maps A and B, and not least in their being engraved with such care and exactitude on stone, as in the maps made by Europeans hundreds of years later. They are apparently the oldest maps on stone in the world, and the maps of which they are copies are probably the oldest and most accurate maps of which we have any knowledge. Nevertheless, both then and for a thousand years longer the Chinese continued to live on a

flat, four-square earth, and had no glimmer of such superior scientific knowledge as that shown in his disc-shaped map by Hecatæus, the successor of Anaximander, as early as B.C. 500; or of Strabo's map in A.D. 19; still less of Ptolemy's world-map of A.D. 150. In cartography, as in many other subjects, the Chinese tree of knowledge was rooted in China and benefited little from cross-fertilization. If we in the west have the advantage of a knowledge more ancient, more deeply rooted, and better developed by a cross-fertilization unknown to China, that is our good fortune; in my opinion both civilizations give promise of a larger future by the cultural benefits they will receive from their closer intercourse. May the present period of political unrest soon pass, so that we can settle down to one of mutual rivalry for the charm of life rather than in the sordidness of mutual strife!

Before the paper the PRESIDENT (Dr. D. G. HOGARTH) said: I have the pleasant task of introducing to you the Professor of Chinese at Oxford, Professor Soothill. It is not because he is Professor of Chinese in my own University but by the common consent of the world that I introduce him as one of those who have known all that is known about the subject of Chinese cartography. Another was the late Sir Alexander Hosie. You will have the opportunity of listening this afternoon to a discourse which will yield nothing in respect of learning to any discourse in any other capital of Europe. I ask Professor Soothill to address you.

Professor Soothill then read the paper printed above, and a discussion followed.

Mr. E. HEAWOOD: I feel some hesitation in speaking on a subject that can really be properly dealt with only by Chinese scholars. I can only say how pleased I am as a student of early maps to have heard the information about those Chinese maps put before us so clearly. I cannot help feeling a certain personal interest in the paper, because I believe it was I who first suggested to Colonel Mills that the maps should be submitted to Sir Alexander Hosie, and I am pleased that the suggestion has borne such good fruit. I also cannot help wishing that Sir Thomas Wade, the first Professor of Chinese at Cambridge, had survived to hear these maps so well discussed, because I remember a conversation with him almost forty years ago in which he urged the study of early Chinese geographers, and said how sure he felt that the study would well repay all the time that was given to it. He even thought that we in our own time might gain some actual knowledge of the topography of distant parts of China from the study of the ancient Chinese geographers. It certainly seems a remarkable thing that the Chinese should have succeeded in making such excellent maps without any use of astronomy. The maps seem superior in many ways to Ptolemy's maps of even the regions best known to him—for instance, in the correctness of the course of the rivers, and so on. Professor Soothill said that the exaggeration of distances shows that there was no astronomical basis, but surely that alone would not prove it definitely, for we get the same exaggeration in Ptolemy's maps. His length of the Mediterranean was very unduly extended, and yet, as we know, his maps were constructed by an astronomical method. All would, in fact, depend on the degree of accuracy with which the length of a degree could be determined. But no doubt there are other good grounds

for saying that the maps were constructed by the help of pedestrian methods only.

Professor Soothill spoke of the Ricci maps, and of course I am very much interested in the discovery of the hand-drawn map of Ricci which seems to be the original of the map preserved in the Society's collection. But I was not quite clear whether there is any definite proof that it was made in 1602. Is that date to be found on the map itself? We must remember that Ricci made two earlier maps, one in 1584 and another about 1599. Does Professor Soothill consider it quite impossible that the map which we saw on the screen was the original of one or other of them? Probably they really were smaller maps.

There is one side of the subject I should like to see gone into rather more fully, and that is the comparison of early Chinese map-making with that prevailing elsewhere about the same period. There were not only Ptolemy's maps, but Arab maps. In the ninth century the Caliph Al Mamun appointed a Commission of experts to compile a series of maps, which seem to have been a revised and extended version of Ptolemy's, and this would be almost contemporaneous with the making of the originals of these maps preserved to us on stone. It seems very remarkable that the knowledge of the Arabs in regard to other parts of the world should not have spread to China at all, seeing that we know that in the eighth and ninth centuries Arab voyages to China were made. Yet apparently there was no interaction whatever between the two foci of cartographical evolution. In conclusion, I can only express my pleasure at listening to what Professor Soothill has put before us.

Lady HOSIE: It is with great trepidation that I address such a learned audience, but I am very grateful to my father for finishing the work that my husband commenced at Mr. Heawood's suggestion. When Colonel Dudley Mills sent the maps, the late Mr. E. H. Parker, Professor of Chinese at Liverpool University, urged my husband to undertake the work. His chief task was to translate the Chinese characters into our Roman lettering. He felt there was a great deal to be done on these two maps, and knew that he could not spare the time to do it all himself. He thought that if he put Roman characters, those who did not know Chinese would be able to work from them. My husband had various ideas about the maps, having just finished making his own map of China. Knowing that at the end of dynasties names of Chinese cities are often changed, he thought he could perhaps date the originals, from which the maps were carved on the stones, by a study of the place-names appearing on them. My father suggests that one of the maps by this test probably belongs to the T'ang Dynasty, and the other is a little later. One of my husband's theories was that the maps were not maps of the cities of China but of the administrative areas. For instance, Chung King, which is on the Yangtze, is built where the Yangtze takes a bend, so that it is up a hillside on a promontory, almost surrounded by water. But on the older map it is shown somewhat inland. In the same way, Canton, the city, is actually on the West River delta, but in the old maps it is also put a little inland. Thus my husband came to the conclusion that the maps were not maps of actual cities but of administrative areas, since maps were originally made for the Emperor and for administrative purposes. This theory was endorsed by Dr. Hu Shih, the Chinese scholar, a Professor at the National University, Peking, when he was lately in England and saw the maps.

My father has not had time to tell you the meaning of the notes at the side of the map, but they are extraordinarily interesting. There are seventy-four nations to the north, and a great number to the east, which are named on the

"Map of China and Barbary." The notes have been translated by him into English so that the general public can read them. One that interested me was in regard to the "Kingdom of Women," which is said to be 5000 li east of Korea. To the north is the "Kingdom of the Wandering Demons," and so on. The source of the Yellow River is also referred to in some of these notes. Except that it flowed through the K'unlun Mountains, the initial course of the Yellow River was for long a great puzzle to Chinese geographers and cartographers. I always remember a Chinese teacher who told me that the source of the Yellow River was the River of Stars, the Milky Way, which bends down to the Earth. That is not, however, stated on the maps; they are much more scientific and place the actual source of the Yellow River in Tibet.

General Sir EDMUND BARROW: What does the lecturer mean when he speaks of China and Barbary?

Professor SOOTHILL: That is an interpretation of my own. The map itself uses the word *yi*, which has generally been translated "barbarian." I have used the term to indicate that China was the one civilized country and all the rest were barbarian kingdoms. The latter I cut down to Barbary, thinking the term would be understood.

The PRESIDENT: I think the word "Barbary" was used in the sense in which it was used by the Ancient Greeks and is still used by the modern Greeks. When I lived in Athens and the Greeks were annoyed with certain western countries, the gates of the Acropolis were ordered to be closed to the "Barbarians," by which was meant all other nations of the world. Would Professor Soothill tell us when the Chinese accepted the sphericity of the world? I dare say it is not entirely accepted even now any more than we have given up geocentricity in practice, whatever we have done in theory.

Professor SOOTHILL: One regret I have is that my daughter did not give the lecture instead of myself. She would not have been so profound, but much more interesting. As to the question put by the President, the spherical nature of the Earth has been recognized by the Chinese officially, I think, only during the last twenty-five or thirty years, prior to which, so far as I know, there was no recognition of it whatever, the Earth remaining a four-square Earth. Most of the time I spent in China it was usually expressed in that form, the people believing the Earth to be flat; and my daughter could tell you of the difficulty she has had in inducing Chinese girls and women to believe the Earth is not flat.

As to the Ricci map, all I can say is that it was given to me at the Palace, and I was told that the original map is still in existence there. I cannot tell you at the moment whether the date is on the map itself or not, but I will look that up and let Mr. Heawood know. I have little doubt that it is the actual map that was presented by Ricci to the Emperor Wan Li in 1602, and which was accepted by him.

[Professor Soothill then described the maps in fuller detail, remarking that the net map was more recent than the other (Chia Tan's), and pointing out how well it showed the Shantung promontory. The whole of the coast-line was more accurate and the river system reasonably so. He thought the accuracy of the coast-line arose from the fact that the eastern part of China had become better known, because political pressure at the time the map was made was from the north-east, whereas formerly it had been from the north-west. If the map was made before 802 the centre of government would have been in Western China.

In Chia Tan's map there was very little sign of the Shantung promontory

but whereas on the net map no mountains were shown, the various ranges were fairly accurately marked in Chia Tan's map. He considered that the descriptive material was of places that appeared on the original map, with the difference that a very large portion was given over to historical geography descriptive of what happened in each particular district throughout the various dynasties of China up to the T'ang Dynasty. Lists at the sides of the map named over seventy western nations, between forty and fifty southern nations, whilst in the map itself were many descriptions of the various tribes living in China; altogether, a remarkable summary of the history of the various internal and neighbouring races and of the periods when expeditions were made abroad.

Professor Soothill thought the original Chia Tan map was completed in 802, though the copy of the original was not engraved on stone until 1137.

In conclusion, the lecturer showed the copy of Ricci's map of the world found in the Palace at Peking and made in six sections. The animals were in the original map, but he did not know of any other maps in China which had animals on them.]

Mr. HINKS pointed out that it was generally thought that Ricci got his map from Ortelius and that the Chinese animals were versions of the originals in Ortelius, and with this Professor Soothill agreed.

General Sir EDMUND BARROW thought it should be possible to date the map by the ship shown on it, and Mr. LAIRD CLOWES expressed the opinion that the ship might represent one of any time before 1600, though probably after 1550.

The PRESIDENT: When you turn to the *Journal* to find Professor Soothill's paper you will read a great deal that he has not had time to tell us this afternoon. But from what he has given us you will be able to judge of the advantage in prospect of reading a fuller account, and particularly the notes of Professor Chavannes upon the lettering round the maps. I do not pretend to know anything about this subject. I have been carried away into a world as unknown to me as the planet Mars, and been impressed more than ever by the extraordinary mutual isolation in which the two ends of the Old World have lived for so long. I asked my question with regard to the sphericity of the Earth because you will notice in the room a celestial and terrestrial globe of Chinese work of about the end of the seventeenth century, made, to some extent, under European influence. Then, at any rate, whether they believed in sphericity or not, the Chinese made a concession to our weakness in representing the Earth as round. No one I know of has ever explained that isolation of China except Professor Myres, who contends that primæval ice projecting far down into the Western world divided it for long ages into two parts as effectually as the Earth is cut off from the Moon. Therefore we have this remarkable phenomenon of a civilization bred altogether in isolation, advancing alone in certain ways to great heights, and not until a very late period experiencing any kind of cross-fertilization from outside, not perhaps until a period when it was so stereotyped and so sure of itself that to a great extent it resisted those cross-fertilizing influences which we Western people, though stubborn, have accepted. However, it is not for me to keep you with remarks of this kind. I am sure I am expressing the sense of you all in thanking Professor Soothill for an extraordinarily interesting paper. He showed considerable self-restraint and self-denial in cutting out as much as he did and depriving himself of the pleasure of expounding it. But it will appear in the *Journal*, and I am sure we owe him our great gratitude for what he has told us.

Note: Since Professor Soothill's paper was read we have received from him his translation of the Geographical and Historical Notes on the Map of China and Tartary. Had it been possible to publish in the *Journal* complete reproductions of Maps A and B, with the transliteration of their names by the late Sir Alexander Hosie, we should necessarily have printed these translations also. But since reproduction must be reserved for a future part of the Reproductions of Early Engraved Maps, it seems best to reserve also the Notes for a memoir accompanying the maps.—[ED. *G.J.*]

CAPTAIN COOK'S SHIPS

IN the "Additional Note on Cook's ships, the *Resolution* and *Adventure*," dealing with Francis Holman's painting, which Mr. G. S. Laird Clowes added to his paper in the *Journal* for March last, he stated that previous to the discovery of this painting "the appearance of the ships was known only by small and none too illuminating sketches." The Hydrographer to the Navy has pointed out, however, that there exists in the Admiralty Library a large and detailed drawing, 58½ × 23 inches, hitherto unpublished, showing the *Resolution* and *Discovery* at anchor in Nootka Sound, made by J. Webber, who accompanied Cook's last expedition. We are indebted to the Admiralty for permission to reproduce a part of it in the plate facing p. 556: and a photograph of the whole drawing is now hung in the Society's House with other pictures relating to Cook. The Hydrographer also sent a list of the sketches of the *Discovery*, *Endeavour*, *Resolution*, and *Adventure* which appear in the official accounts of the voyages, and of the original drawings preserved at the Admiralty. This comprehensive list is printed below for reference.

Mr. Laird Clowes, in the same note, further described the *Resolution* as being shown "just about to drop her anchor." The Hydrographer disagrees with this statement, and also with the subsequent detailed remarks as to the evolutions being performed by that ship and by the *Adventure*. He considers that the indications given in the picture are entirely in accordance with the supposition that both ships have just got under way; not at all with the theory that one has anchored and that the other is about to do so. Mr. Laird Clowes accepts this correction: his note was based upon the supposition that the small yacht was being brought-to alongside the *Endeavour*, rather than that it was standing across her bows as she was getting under way.

The ensign of the yacht bears the following coat: Argent, a bend sable charged with three owls gardant argent. Crest: an owl gardant argent. We are indebted to the Chester Herald, Mr. J. D. Heaton-Armstrong, for the information that these were the arms of a family of Savile or Saville. Following up this clue, the Hydrographer identifies the yacht as the property of Sir George Savile, Bart., F.R.S. (1726–84).

Savile, a wealthy man and a prominent politician, was Vice-President of the Society of Arts and Sciences at the sailing of the expedition, and though not himself a Yorkshire man, represented Yorkshire constituencies from 1759 to 1793. These facts would account for his interest in Cook's expeditions. Previously, but for a reference in Mr. Kitson's life of Cook based upon a document which cannot now be traced, Sir George Savile's name had not been associated with Cook's.

List of Original Drawings of Captain Cook's Ships preserved in the Department of the Director of Naval Construction, Admiralty.

Endeavour.

Sheer draught, with dimensions of spars, etc.

Deck plan.

Resolution.

Sheer draught.

Deck plan.

Adventure.

Deck plan only.

Discovery.

No drawings of this ship appear to have been preserved.

List of the Engravings of Captain Cook's Ships appearing in the Published Official Accounts of his Three Voyages.

First voyage in H.M.S. "Endeavour Bark."

'An account of the Voyages undertaken by Byron, Wallis, Carteret and Cook.' (Edited by Dr. Hawkesworth.) 1773.

Vol. II, Plate 2 (opposite p. 80).

Small incidental representation of *Endeavour* in background, masthead height about 2 inches.

Vol. III, Plate 19 (opposite p. 557).

Engraving of *Endeavour* ashore in Endeavour River, masthead height about 3 inches.

Second Voyage, in H.M. Ships "Resolution" and "Adventure."

'Voyage toward the South Pole and round the World . . . by James Cook. 1777.'

Vol. I. Plate XXX.

"The Ice Islands. . . ."

View of *Resolution*, masthead height about $3\frac{1}{2}$ inches.

Plate LIV.

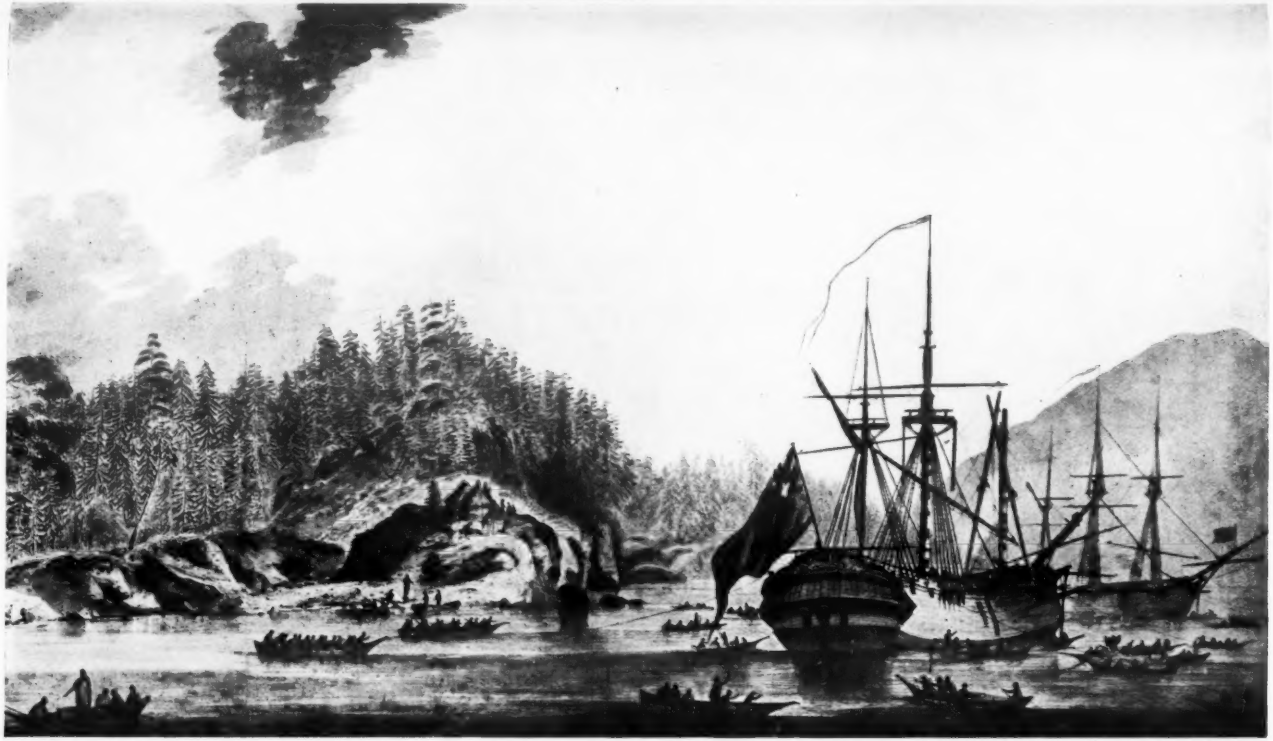
"The Landing at Middleburgh. . . ."

View of both ships in background, masthead height of *Resolution* about 2 inches.

Vol. II, Plate LIX.

"The Landing at Tanna. . . ."

View of *Resolution* in background, masthead height about $7\frac{1}{2}$ inches.



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H.M. Ships "Resolution" and "Discovery" anchored in Resolution Cove, Nootka Sound, Vancouver Island, from the drawing in pen and wash by Webber, in the Library of the Admiralty

Third Voyage, in H.M. Ships "Resolution" and "Discovery."

'Voyage to the Pacific Ocean . . . by Capt. James Cook and Capt. James King. 1784.'

Vol. I.

Plate IV. "A View of Christmas Harbour. . . ."

Small view of both ships, roughly broadside on. Masthead heights, *R.* 2 inches, *D.* 1·3 inches.

Vol. II.

Plate XXXI. "A View of Huaheine."

Small view of both ships, broadside on. Masthead heights, *R.* 2 inches, *D.* 1·2 inches.

Plate XLV. "A View of Snug Corner Cove . . ."

Small broadside view of both ships (almost too dark to be made out). Masthead heights, *R.* 0·8 inch, *D.* 0·5 inch.

Plate LII. "Sea Horses."

View of both ships, bows on and without much detail. Masthead heights, *R.* 1·3 inches, *D.* 0·8 inch.

Vol. III.

Plate LXVIII. "A View of Karakakooa."

View of both ships, broadside on. Masthead heights, *R.* 2·3 inches, *D.* 1·5 inches.

Plate LXXIV. "A View of the Town and Harbour of St. Peter and St. Paul."

Very small view of both ships, broadside on. Masthead heights, *R.* 0·5 inch, *D.* 0·4 inch.

These larger plates are usually bound in a separate folio volume, and may easily be overlooked.

A GRAPHICAL DISCUSSION OF THE FIGURE OF THE EARTH

Arthur R. Hinks, C.B.E., F.R.S., Sec. R.G.S.

Read at the Afternoon Meeting of the Society, 28 March 1927.

IN a paper read to this Society on the afternoon of 12 May 1924 Captain McCaw gave a summary of the analytical methods of determining the figure of the Earth (*Geogr. Journ.*, August 1924, **64**, 120), which makes it quite unnecessary for me to say anything to-day on the classical side of the question. I shall confine myself to describing the outcome of a suggestion which I made in the course of the discussion which followed that paper.

Captain McCaw had referred to the large amount of geodetic triangulation which has never been utilized for the calculation of the Earth's figure, and added that the failure to use all this material is not surprising if it is realized that the labour of incorporating it all in a comprehensive

solution would consume great part of a lifetime. It appeared to me however that if certain geodetic tables on a new plan were calculated, it would be easy to make a graphical adjustment of arcs calculated on any one figure and thus compare them with any other figure, thence deducing pretty accurately the contribution which any arc would make to a general solution for the figure of the Earth.

The most important of the new tables was to be a table of the lengths of the meridian arcs from the equator to each ten minutes of latitude, with the effect upon these lengths of a change of one per cent. in the value adopted for the reciprocal of the flattening. It is singular that no general table of meridian arcs had ever been calculated on any figure. Bessel had done it for a few degrees, and the Geodetic Survey of South Africa for a few more, on a different figure;* but there was no general table on any figure, and nothing to show how small or great were the differences in the same arcs computed with different values of the flattening.

Soon after the meeting at which this proposal was made it became possible to undertake the construction of these tables. Captain McCaw put together the necessary formulæ; the Government Grant Fund of the Royal Society shared with our Society the cost of the calculations, which with the kind assent of the Astronomer Royal were undertaken by two computers of the Royal Observatory under the superintendence of Dr. Jackson. For reasons which are fully explained in the report of the discussion on Captain McCaw's paper, Clarke's figure of 1880 was chosen as the basis of the tables, and in a few weeks the Table of Meridian Arcs was in print, with the variations arising from changes of one and of two per cent. in the flattening.

Meanwhile with the assistance of Mr. Jolly of the Ordnance Survey the figures for the discordances "Geodetic minus Astronomical latitude" were dug out of the principal discussions, and a rapid graphical examination of the results was prepared for submission to the meeting of the International Union of Geodesy and Geophysics at Madrid. In a brief memorandum, supported with four large diagrams beautifully reproduced at the last moment by the kind co-operation of Colonel Winterbotham, I demonstrated to my own satisfaction, but not apparently to that of any one else, that Clarke's figure of 1880 represented the principal meridian arcs at least as well as did any other. The method by which Hayford's figure of 1910 was adopted by the Madrid meetings as the Standard figure for international use has been described in the *Journal* for December 1924, **64**, 477. It will be sufficient to say here that not even a single one of my colleagues in the British delegation could be induced by the most eloquent diagrams to make a fight for Clarke 1880. They allowed without dissent the adoption of 1/297·0 for the flattening,

* Väisälä also had recently included such a table in his Geodetic Tables on Hayford's Figure for the latitudes of Finland, 59° to 71° (Veröff des Finnischen Geod. Inst. Helsinki, 1923).

and were beaten by a narrow majority of those voting, on a proposal to adopt a round figure for the radius of the equator, as against Hayford's value 6,378,388 metres.

It may well be asked why, in the face of this failure, the New Geodetic Tables for Clarke's Figure of 1880 have since been completed, and are soon to be published as Number 4 of the R.G.S. Technical Series. The following seem to me to be sufficient reasons :

The tables of Meridian Arcs, and of the logarithms of the Radii of Curvature functions, are furnished each with a column showing the effect of a one-per-cent. change in the reciprocal of the flattening, so that it is very simple to deduce the corresponding quantities for any figure within the bounds of possibility. In the original form, as circulated at Madrid, these differences were given for changes of one and of two per cent., because it was found that they were not quite sufficiently proportional to the change of flattening to allow of simple interpolation. More or less by accident, however, it was found later that the change for two per cent. had a constant ratio of 1·9804 to the change for one per cent., and that this was exactly the same as the ratio of the corresponding n's, where $n = (a - b)/(a + b)$. This proved to be true to a much higher degree of accuracy than one would have expected from the form of the expressions for the quantities tabulated, and allowed a much more precise transformation from one figure to another, so that it was worth while to calculate the one per cent. difference to more decimal places, while abolishing as no longer necessary the two per cent. column.

It is shown by many examples in the Introduction to the Tables that we may transform from one Figure to another with an accuracy of about a unit in the ninth significant figure. Incidentally the principal published geodetic tables were thus compared and verified ; and finally the whole of the tables calculated for Clarke 1880 were transformed to Hayford 1910, or Madrid 1924 as it may be convenient to call it in future, to mark its international status.

The published tables include therefore the values of the meridian arcs and of Log M, Log N, and Log O for Clarke 1880, with their first differences ; the change for a variation of one per cent. in the reciprocal of the flattening ; and the values of the same quantities for Madrid 1924. The introduction gives a table of the factors to transform to any other of the principal figures.

This is perhaps a sufficient explanation why the original project has been pursued, with important improvements and additions. But there are other reasons.

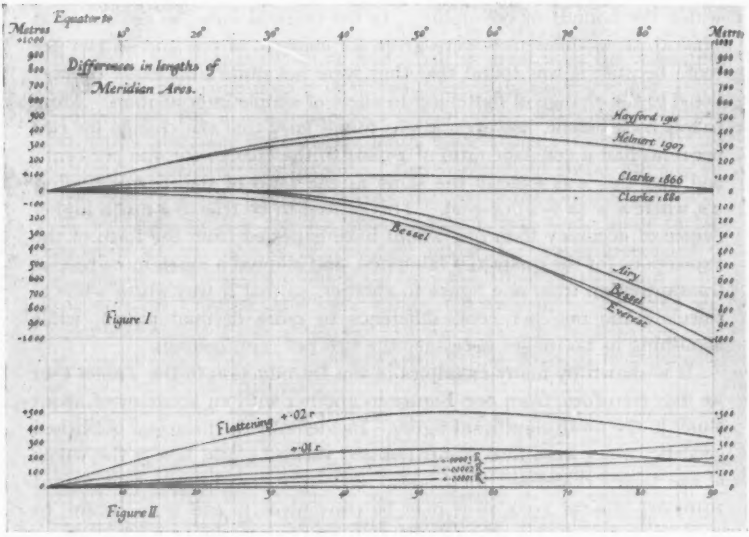
Further study of the problem has confirmed my belief that there is a good case for each of the following propositions which were enunciated at Madrid :

A. Meridian arcs in low or in middle latitudes cannot distinguish between errors in the radius vector and errors in the flattening. The critical arcs are those between latitudes 40° and 70°.

B. The only arcs which satisfy these conditions approximately are the Franco-British and the Russo-Scandinavian, and neither of these gives any clear evidence against the figures of Clarke 1880.

C. There is distinct evidence of some deep-seated disturbing cause which distorts the geoid in latitudes ± 30° to 20°, and must be further investigated before we can be sure that the meridian sections of the geoid are sensibly ellipses.

The preliminary communication on these matters made at Madrid



I. Differences of lengths of Meridian Arcs calculated on the principal Figures of the Earth

II. Effects of changes in Radius and Flattening

will eventually be published in the *Travaux* of the Section of Geodesy. But since the next meeting of the Union is in sight, it may be well to give the evidence briefly here, and to add some further propositions for discussion.

D. The isostatic calculations of Dr. Heiskanen for the European arcs tend to confirm the conclusion that Clarke 1880 is a better figure for Europe than Madrid 1924, but show at the same time that the observed astronomical latitudes on these European arcs are quite insufficient to give any certain result.

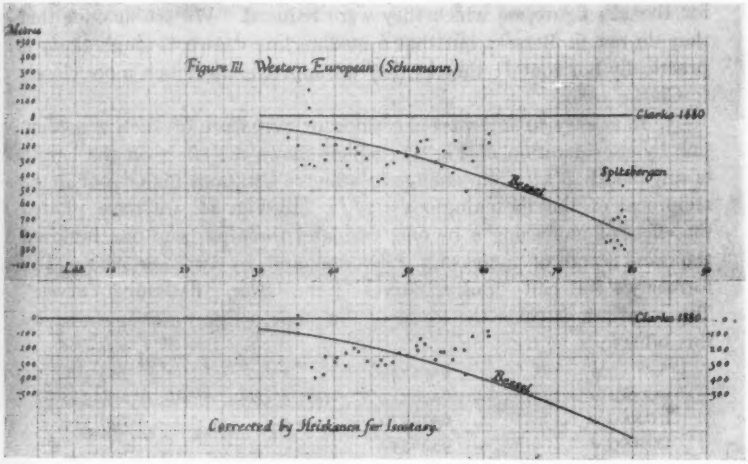
E. A similar graphical process can be used to discuss the gravity

determinations, and confirms Dr. Heiskanen's conclusion that the effective flattening is different in different longitudes, while casting doubt on the efficacy of his longitude term to represent the difference.

F. The most effective immediate contribution to the problem would be an extensive determination of astronomical latitudes at or about the stations of the Franco-British and Russo-Scandinavian arcs.

G. The configuration of the southern hemisphere makes it impossible to derive an independent figure of the Earth in that hemisphere, but if the radius vector is derived from the northern hemisphere the measurement of meridian arcs will give a determination of the flattening in the southern hemisphere.

The following paragraphs 1 to 10 are, with slight abbreviation,



III. The Western European Arc compared with Bessel's Figure
(a) from the Deflections calculated by Schumann
(b) from the Deflections corrected for Isostasy by Heiskanen

the same as in the communication made to the Section of Geodesy at Madrid.

1. In Fig. I. I have plotted the differences in the lengths of meridian arcs for several of the principal figures, compared with Clarke 1880. Thus, for example, the arc from the equator to latitude 50° is about 95 metres greater for Clarke's figure of 1866, and 212 less for Everest's figure. One sees at once that although Everest's figure (a 6377276 m.; f 1/300·802) is very different from Clarke 1880 (a 6378245) m.; f 1/293·465), yet over the range of latitude (8° to 30°) for which Everest's figure has been used, the meridian arcs are very little different from those of Clarke, and a very small transformation will be required to refer

meridian deflections from one figure to the other. Similarly, over the range of latitude (25° to 50°) for which Clarke's figure of 1866 has been used in the United States, the differences from Clarke 1880 are very nearly constant.

2. Now suppose that we have a set of meridian deflections G − A referred to Bessel's figure. Let the deflections in seconds of arc, as ordinarily given, be turned into metres, and plotted against the curve for Bessel in Fig. I. We can see at once, by inspection, how they will fit any other of the figures whose curves are plotted. We draw a median line or curve as best we may through the plotted points and judge of the fit to other figures by the approximation to parallelism with their curves. For example, in Fig. III. we have plotted the meridian deflections deduced by Schumann* for the Franco-British arc against the curve for Bessel's figure, on which they were reduced. We see at once that they do not fit Bessel: but that a median line drawn through them is practically horizontal: that is, they do approximate much more closely to Clarke 1880.

3. It is easy to interpret the slope or curvature of such a median line by consideration of Fig. II., which shows the effect on the length of any meridian arc from change in adopted semi-axis major a or in the reciprocal of the flattening r $(= 1/f)$. In Fig. II. we have plotted the effect of increasing a by one, two, and three parts in one hundred thousand; and of increasing r by one and by two per cent. The former we will call "radius curves"; the latter "flattening curves." These variations cover the range of the modern figures, as is shown by this table:

a	...	...	6378249	r	...	...	293·465
1·00001 a	...	...	6378313	1·01 r	..	...	296·399
1·00002 a	...	...	6378376	1·02 r	...	...	299·334
1·00003 a	...	...	6378440				

The "radius curves" are on the scale of any diagram indistinguishable from straight lines; the "flattening curves" are very nearly straight between latitudes 0° and 30°; they rise to a maximum about latitude 54°; the chords from 40° to 70° or from 45° to 65° are horizontal.

4. Now any median line or curve drawn among a series of points representing meridian deviations from any assumed figure should approximate to a curve compounded of a radius curve and a flattening curve: and our object is to disentangle the two components. We see at once:

(*a*) That in tropical and sub-tropical latitudes the compound curve is so nearly straight that the components cannot be distinguished. Hence a meridian arc in these latitudes can by itself make no discrimination between radius and flattening.

(*b*) That an arc in middle latitudes, between 30° and 50° may begin

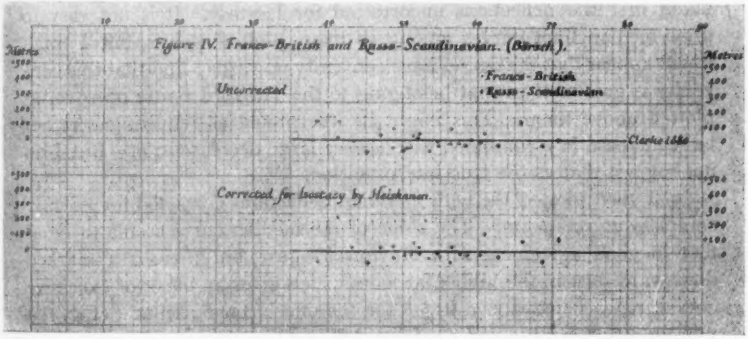
* C. R. Int. Geod. Assoc., Budapest, 1906, I. 244.

to show a curvature due to the flattening component, but this curvature is so small that no good separation is possible.

(*c*) That the most useful single arc is in high temperate latitudes between 40° and 70°. If the median line or curve is drawn through a series of plotted points, the difference of ordinates at the two ends gives immediately a correction to the semi-axis, independent of the flattening; while the curvature of the median curve gives a rough indication of the correction to the flattening.

With these guiding principles we may proceed to discuss the principal geodetic material.

5. Consider first the arcs in higher latitudes covering the critical portion of the curve. We have already seen that Schumann's reduction of the Franco-British arc gives a median line practically horizontal (Fig. III.). The combination of the Franco-British and Russo-Scandi-



IV. Combined Franco–British and Russo–Scandinavian Arcs compared with Clarke's Figure of 1880

(*a*) *from the Deflections calculated by Börsch*

(*b*) *from the Deflections corrected for Isostasy by Heiskanen*

navian arcs by Börsch* (Fig. IV.) gives much the same. If the median curve is not a straight line its convexity is downwards. By 4 (*c*) we conclude that these arcs indicate no increase in *a*, and if anything a decrease in *r*.

6. Take now the great Indian Arc of Meridian. The median curve slopes up steeply to about latitude 22°, then down steeply to about 25°, and then up very steeply to latitude 30°. The last is doubtless due to the abnormal attraction of the Himalaya and the plateau of Tibet. The intermediate slope downwards is usually attributed to the "Gangetic trough." The first slope upwards from latitude 8° to 22° might be taken to require a considerable increase in *a*, or in *r*, or in both.

7. The South African arcs, due to the initiative of the late Sir David

* Int. Geod. Assoc., Paris, 1889. Annexe A. 11.

Gill, have been discussed in a preliminary way by Bahn ('Beiträge zur Geophysik,' vol. 10). The figures he gives are not quite the same as those in the original reports. I have used the latter, and have included a number of stations not used by Bahn. The result has a curious analogy to the Indian results. The median line slopes up strongly to about latitude 22° and then strongly down again, thus repeating in the southern hemisphere the phenomenon of the "Gangetic trough." It would seem, therefore, that this effect may be more than a local phenomenon of India. The abnormality common to the two makes it impossible at present to deduce from either any corrections to a or to r.

8. We will next extract from the voluminous material discussed by Hayford ('The Figure of the Earth and Isostasy') the meridian deflections along the Arc of the 98th Meridian, and the Eastern Oblique Arc with its extension into Florida. Fig. VII. shows the results plotted against the curve of Clarke 1866, from which they were derived. I have taken first the deflections uncorrected for Isostasy. It is not easy to draw median lines curves among so many plotted points, but I think it will appear that the curves have convexity upwards: and that this convexity is greater than that belonging to the Hayford figure of 1910, as plotted above them. This might be interpreted as requiring a rather large increase in r combined with a very large decrease in a. But I do not suggest that as the true interpretation.

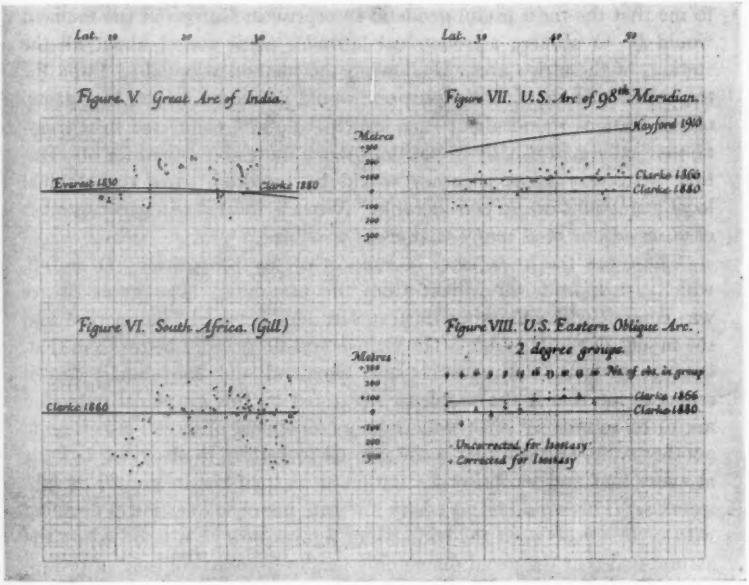
9. I then plotted the 98th meridian deflections corrected for isostasy complete at 120·9 km. The slope of the median curve seems to be at first in good agreement with Hayford's figure, but there is a marked downward turn in the higher latitudes which gives an effect of excessive curvature, as noted above in § 8 for the uncorrected results. (Fig. not reproduced here; but see *Travaux*, Madrid.)

In Fig. VIII., to avoid the scatter, I have combined the individual results of the Eastern Oblique Arc into means for each 2° of latitude, and plotted both uncorrected and corrected. There is a marked difference between the two: but it should be noted that the results corrected for isostasy give on the whole a smaller slope and confirm the turning down in high latitudes.

In general, one may say that these two U.S. arcs are not markedly discordant from the Hayford figure of 1910 to which they contributed: but that the rather abrupt turn downwards above latitude 40° is disquieting, especially since it is seen quite clearly in both the arcs.

10. I had hoped that the results of the remeasurement of the Arc de Pérou (courteously communicated by Colonel Bellot) and of the Russian section of the Spitsbergen arc (the Swedish section is still unavailable) would have made an important contribution to this discussion. Unhappily it was immediately evident that these isolated arcs are too short or the irregular deviations of the vertical are too large, to allow any deductions from them.

Since the Madrid meeting the results for the Franco-British and Russo-Scandinavian arcs have been corrected for isostatic compensation by Dr. Heiskanen (*Die Erddimensionen nach den Europäischen Gradmessungen*, Veroff. Finn. Geod. Inst. No. 6, Helsinki, 1926), and are plotted in Figs. III. and IV.* It is at once apparent that the correction has somewhat improved the fit, without changing the first conclusion, that these arcs fit Clarke 1880 as well as they fit any other figure. If the Madrid radius is right the median curve should stand 74 metres higher at 70° than at 40°; and if the Madrid flattening is right the median curve at 55° should be 24 metres above the chord 40° to 70°. The



V. The Great Arc of India calculated on Everest's figure
VI. The Arc of South Africa (30th Meridian) on Clarke 1880
VII. The U.S. Arc of the 98th Meridian on Clarke 1866
VIII. The U.S. Eastern Oblique Arc, with correction for Isostasy

results are so scattered that we can derive no certain result. If there is any convexity in median curves, it would seem to be downward rather than upward. If we disregard the very discordant results in Schumann's lower latitudes, and imagine that the rest give a decided general slope upwards, we find little confirmation in the Börsch results; and cannot

* A few of the Franco-British results used by Börsch but not by Schumann have not been calculated by Heiskanen: hence a few points are missing from the isostatic plot.

but feel that one or two more observations might alter the whole effect.

It is therefore clear that the number of astronomical latitudes is quite insufficient to give a satisfactory solution, especially in the Russo-Scandinavian arc, which has only thirteen in all. It is said that Struve did not mark his stations with sufficient care, and that most of the Scandinavian stations are lost, while many of those farther south were destroyed during the war. One would hope, however, that they could mostly be recovered within a few metres, while the discordances between the geodetic and the astronomical latitudes are equivalent to a hundred or two. The stations of the Franco-British arc are mostly well marked. It appears to me that the most useful geodetic enterprise in Europe at the moment would be to observe astronomical latitudes at or round about all the stations of these two arcs. Following the method adopted in India for the initial latitude of Kalianpur, one would probably observe at a group of sub-stations round about each principal station, connected to it trigonometrically, and usually in positions much more convenient for observation. No very great accuracy would be required, since the residual local attractions are so considerable. What is wanted is a great number of observations at as many stations as possible.

These are the arguments in support of my propositions D and F, which are indeed self-evident from the diagrams. The great Struve was content with observing thirteen latitudes between Hammerfest and the mouth of the Danube. The British and French did better than that, having thirty-one latitudes between Shetland and Barcelona. But it seems to me that if the problems suggested by this graphical reduction are to be solved, we must undertake astronomical observations on quite another scale, and consider it the normal procedure to observe a latitude at every first and second order station at least, if not in groups of sub-stations. This would be necessary if it were merely a question of deciding with certainty between the contending figures now in use, based on the assumption that the geoid differs only locally from an ellipsoid of revolution. It is doubly necessary if the ellipsoid may have three unequal axes. But it is many times necessary if one must admit the possibility that there are in the Earth deep-seated irregularities which make the ellipsoid only a poor approximation to the truth ; and that is what some of the above results, especially the South African arc of meridian, most strongly suggest.

The graphical discussion of Gravity Surveys.

It is natural to examine whether this possibly fruitful and very simple way of looking at the problem can be extended to the discussion of gravity surveys. Happily there is in the memoir of Dr. Heiskanen (*Untersuchungen über Schwerkraft und Isostasie*, Veroffentlichungen des Finnischen Geodätischen Institutes No. 4, Helsinki, 1924) a rich store of material ready to hand.

Dr. Heiskanen refers his calculations to the expression used by Borrass, which is conveniently designated Helmert I.

$$\gamma_0 = 978{\cdot}030(1 + 0{\cdot}005302 \sin^2\phi - 0{\cdot}000007 \sin^2 2\phi)$$

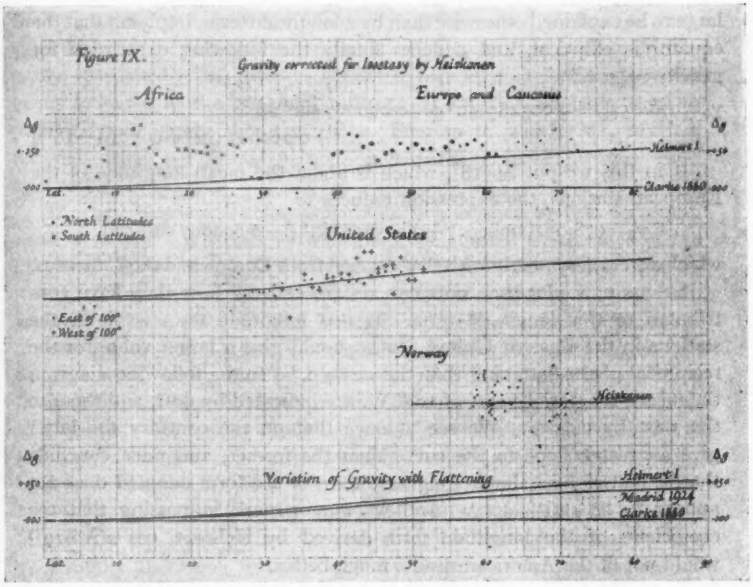
A change in the flattening affects the coefficient of $\sin^2\phi$. Thus the corresponding coefficients for the flattening of Clarke 1880 and of Hayford 1910 (Madrid 1924) are 0·005248 and 0·005289. If then as before we take Clarke 1880 as the base of ordinates, and plot the differences of Madrid and Helmert I from the curves

$$y = 978(0{\cdot}000041) \sin^2\phi$$

and

$$y = 978(0{\cdot}000054) \sin^2\phi$$

we have the following results (Fig. IX.) :



IX. Graphical Examination of Gravity Observations

We see at once that the difference between Clarke 1880 and Madrid 1924 is equivalent to a variation of 0·020 in the value of gravity between the latitudes 40° and 70° : a difference which should be plainly visible in the gravity determinations of Europe alone.

Let us now plot the gravity anomalies (referred to Helmert I) given in column 2 of Heiskanen's table XIII., pp. 82 *et seq.* for stations in Europe and the Caucasus, corrected for Hayfordian isostasy with depth of compensation 113·7 km. His figures are given as means for each degree square. I have further combined them into means for all the degree

squares for a degree of latitude, and have indicated roughly by the size of the dots the number of squares thus combined. I have extended the diagram into lower latitudes by adding the stations on the coast of Africa, showing them by crosses instead of dots.

One would say at once that the best curve drawn through this assemblage of points is not far from a horizontal straight line: that is to say, the flattening deduced from these results cannot be far from that of Clarke 1880. In fact, Heiskanen from his solution by least squares deduces from Europe and the Caucasus (the dots) a flattening 293·8, or if Africa is taken in, 294·5. On the other hand, from stations in Asia alone he gets 299·8, and from the United States alone 299·2, while from a combined solution for all he derives 297·4, or very nearly the figure of Madrid 1924. He concludes however that these differences are too large to be explained otherwise than by a longitude term, implying that the equator is elliptical, and deduces finally the following expression for gravity:

$$\gamma_0 = 978{\cdot}052[1 + 0{\cdot}005285 \sin^2\phi - 0{\cdot}000007 \sin^2 2\phi + 0{\cdot}000027 \cos^2\phi \cos 2(\lambda - 18°)]$$

If in this we put $\lambda = 18°$, which is about the mean longitude of the European stations, the expression reduces to

$$\gamma_0 = 978{\cdot}052[1{\cdot}000027 + 0{\cdot}005258 \sin^2\phi - 0{\cdot}000007 \sin^2 2\phi]$$

which agrees very nearly with that derived from Europe and the Caucasus.

Let us now plot the American results and see how they have contributed to this longitude term. If this longitude term is right, the stations in the Eastern United States should give a larger value for the reciprocal of the flattening than the western.* In the following diagram the means for stations east of 100° W. are indicated by dots, and those to the west by crosses. We see at once that on the contrary the latter give a greater slope to the curve than the former, and must conclude that at first sight a simple longitude term of the form adopted does not appear to be satisfactory. And we may remark in passing that the coefficients of the longitude term derived by Helmert, $\cos 2(\lambda + 17°)$ would not fit the American results much better.

In his discussion of 1924 Heiskanen omitted the gravity determinations in Norway, because he was not able at that time to reduce them for isostasy. In a more recent paper: *Schwerkraft und Isostatische Kompensation in Norwegen*, Helsinki, 1926, he has calculated the gravity anomalies for forty-six stations, referred to his own formula for gravity. Neglecting the longitude term, and plotting them with respect to the curve expressing the deviation from the flattening of Clarke 1880, as before, the result in Fig. IX. shows clearly that the Norwegian results tend quite strongly to thrust the curve downwards in high latitudes, or

* Between longitudes 70° and 100° W. the average coefficient of $\sin^2\phi$ is about 0·005308; between 100° and 130° W. it is 0·005287, by Heiskanen's formula.

to bring the reciprocal of the flattening below Clarke's value, instead of above it.

It seems to me, therefore, that this preliminary reconnaissance of the gravity results shows that at any rate for Europe Clarke's flattening is very near to the truth, and that the Conference of Madrid was unfortunate in imposing upon Europe a figure of the Earth which may fit the United States tolerably well, though not without suspicious signs of abnormality, but which does not clearly fit Europe at all well, whether one judges by deviations of the vertical or by anomalies of gravity.

Before we can say with confidence what figure—if any—is most fit to be adopted for the world in general, we must investigate more fully those abnormalities which have come to light in the present graphical discussion, and others which will doubtless appear when accurate geodetic work is extended beyond its present rather restricted limits At each stage I would suggest that the observations may with advantage be discussed graphically, in order to see what sort of contribution they are going to make to the general problem. If they do no more than to postpone indefinitely that task of a lifetime to which Mr. McCaw referred, these graphical methods will perhaps have justified their existence.

The new Geodetic Tables which will be published by this Society in the course of a few weeks were originally suggested by the idea of the graphical discussions, but of course go far beyond its possible requirements. They have in fact been computed to a degree of numerical accuracy beyond what can ever be justified by our real knowledge of the dimensions of the Earth. We shall never know to a millimetre the distance from the equator to Fuglenaes. But bitter experience during the war showed how necessary it is for the computer of large-scale grids to have at his disposal, as a foundation, tables which are self-consistent to an almost unnatural degree ; and much the same need arises in peaceful cadastral survey. We have therefore taken much trouble to get these tables correct to the last figure printed. As a final check after the tables were put into type Dr. Comrie, of H.M. Nautical Almanac Office, very kindly undertook to build them up entirely anew from the second differences on the electrically operated calculating machines which are now in use in that office. He found only two mistakes of any consequence, but was able to smooth last figures so successfully that fourth differences of 6 are very rare, and there are none greater. One of these machines printed automatically an independent copy of the tables, which will be used for a final reading after the tables have been stereotyped. He is not willing to say more than that " it is believed that all the quantities printed are correct to a unit of the last decimal," but admits that the limiting error of a unit is probably rarely attained. For all practical purposes we have confidence, therefore, that the tables are numerically perfect, and for that have to thank in the first instance Dr. Jackson and his com-

puters at the Royal Observatory, and finally Dr. Comrie and his machine operators at the Nautical Almanac Office.

As a final check on the accuracy of the expressions used in the calculation I have compared the columns for Madrid 1924 between latitudes 59° and 71° with Väisälä's tables. His third place of decimals of a metre in the Meridian Arcs either agrees with mine or is one unit greater; his values for log M and log N to eight places agree exactly (except for one slight misprint of his) with my nine-figure tables reduced to eight. This is a complete and satisfactory verification both of the expressions from which the tables for Clarke 1880 were calculated, and of the method and results of the transformation.

Before the paper the CHAIRMAN (Col. Sir CHARLES CLOSE) said: We are going to listen this afternoon to an important paper by Mr. Hinks on "A Graphical Discussion of the Figure of the Earth," a paper of which some of you may have seen a proof; a really valuable paper containing many new ideas. I will call upon Mr. Hinks to read it.

Mr. Hinks then read the paper printed above, and a discussion followed.

Col. Sir GERALD LENOX-CONYNGHAM: I would like to say a word or two with reference to Mr. Hinks' evident dissatisfaction with his colleagues at Madrid. I was one of them, and I think I may be allowed to give a little explanation.

It had been decided pretty definitely by the Congress that it was desirable to come to some decision at that meeting; to adopt some figure, not to leave the matter over for another three years. Also at these international meetings one knows that what is said at a session when all are present is not, as a rule, very fully understood—there are too many people speaking different languages—so that one must ascertain the feeling of different members of the Union by conversations between the meetings. The British delegation, I think, had arrived pretty clearly at the idea that there was no hope of getting the Clarke figure of 1880 accepted; that we had to concentrate upon some policy other than that—on some decision which was not for Clarke 1880. For the flattening the figure of 1/297·0 had strong support from the fact that it had been adopted, I think I am right in saying, by the Nautical Almanac and by the Astronomical Union on grounds other than geodetic.

Then, as Mr. Hinks has mentioned, we attempted to get carried a value for the radius of the Equator which was a round figure. This was intended to indicate that we did not think there was any sense, on the evidence before us, in expressing that radius down to a single metre. However, the vote went against us. But I would not be inclined to think that any great harm has been done. What was wanted was not an expression of opinion as to what was the actual figure of the Earth, but to get the different countries to adopt one figure as a figure of reference so that all anomalies should be, as far as is possible, in the same terms, and thus we should not have the different curves that Mr. Hinks has shown us, but should have everything expressed in terms of one spheroid. I think the task before geodesists of deriving results from the observations in different countries will be considerably simplified if the different countries will express all their geodetic anomalies in terms of one spheroid of reference. It does not matter very much whether that spheroid of reference

is a very close approximation to the truth or not; it is the adoption of one spheroid for general use that is important.

But let us suppose for a moment that we did at Madrid make a serious blunder, that we have adopted a figure which is not very near the truth and which we shall have to give up in the future. That would have seemed rather serious three years ago at Madrid, but now, with Mr. Hinks' tables, it does not seem to involve any trouble at all. He has provided us with such a beautiful tool that I believe the transformation of geodetic data from one spheroid to another has become a simple and easy thing which can be done quite mechanically by anybody with those tables in his hand. So that the first point I would like to make with regard to the tables is that they provide a most convenient tool and one which, I think, can be very easily and safely used. There is always a danger in using a new tool that you may cut your fingers, but I do not see at present that there are likely to be pitfalls in the use of these tables.

I was much struck by two things in what Mr. Hinks has said. The graphical method that he has shown us seems to me to be most useful in indicating the direction in which it would be well to turn geodetic effort. He showed, for instance, from his diagrams that the observation of certain latitudes would be useful. That sort of question is rather difficult to deal with by ordinary methods, and I think this graphical method will be extremely useful in that respect.

Lastly, almost at the end of his paper Mr. Hinks used these words: "Before we can say with confidence what figure—if any—is most fit to be adopted for the world in general . . ." I take it that by that "if any" Mr. Hinks means that we may find that the flattening is pretty different in different longitudes, and that it may not be convenient for different countries to reduce all their surveys to the same spheroid; that possibly it would be well for each country to determine its own flattening and its own figure and to reduce its surveys to that figure. That is a very interesting consideration. If we find that the geoid does not approximate closely to any ellipsoid whatever, that will indicate that each country should adopt its own figure and refer its surveys to that figure. This is perhaps a refinement which is not very necessary from a practical point of view, but it is an interesting consideration and one which is new to me.

Col. H. S. L. WINTERBOTHAM: I was also struck, like Sir Gerald, with Mr. Hinks' words in the expression "if any," because quite apart from the scientific aspect of the case we have to consider what capital is locked up in the various figures in use in different parts of the world. It is certainly safe to say that the geodesy of the British Empire at the present moment is constructive rather than analytical. We cannot expect geodesists who are at present at work in Africa—I wish one could say they were at work in all parts of the Empire—to put their results in terms of a special figure for the convenience and education of the assembled geodesists at Prague. They have not the time, nor will they be able for many many years to put their results in terms of that figure which may prove to be the best for that continent. On the other hand, they might reach a practical solution in getting the whole continent on one figure, though that figure may differ from the one which we have adopted for the world at large. Africa as a continent is, as a matter of fact, almost entirely on the Clarke figure of 1880. You may go from Cape Town to Mount Ruwenzori upon Clarke's figure of 1880. You may go all through Northern Africa also on that figure; and the Belgians have agreed to use it in the Congo. We are doing a great deal of work at present in connection with Boundary Commissions in conjunction with the Belgians, and we shall hope soon to have

interesting data upon which, we trust, Mr. Hinks may experiment to see whether that Northern Rhodesia anomaly really exists. On the other hand practical uniformity in Asia is not, it would seem, possible. In that connection I would like to know what the effect of the longitudinal extension of the Everest figure may be, because it is, I think, greater than its range in latitude. The Everest figure extends, for example, to Mosul on the west and to Singapore on the east.

I was another of Mr. Hinks' colleagues at Madrid. His proposal, unfortunately, had a political aspect as well as a scientific. The Clarke 1880 figure is one which is widely used by the Allies and not at all by the Central Powers. It seemed, then, rather unwise and untimely to press for its universal adoption.

Finally, I should like to express my personal thanks to Mr. Hinks for his paper. From a profound study of intricate mathematics we have all of us, I expect, arisen exhausted, unconvinced, and possibly uncomprehending. From a simple graph we may not get, perhaps, that precision which must finally be obtained, but we do get those broad and evident conclusions which enable us to understand the work of more profound mathematicians than ourselves.

Mr. G. T. McCaw : I should like to say that this is one of the most interesting papers from my point of view that I have read for a long time. I should like to help in throwing some light on Mr. Hinks' main propositions. The analytical method is more or less independent of the graphical, and it will be found to lend support to many of his conclusions. If a certain spheroid is taken as reference, the difference between the astronomical and geodetic measure (A—G) of a component part of a meridional arc gives an equation wherein the (A—G) above is expressed in terms of a change of the semi-axis major and a change in the eccentricity of the meridional ellipse. Robbed of its trappings, the equation becomes—

$$\Delta\phi\frac{\delta a}{a} - \tfrac{1}{4}\Delta\phi(1 + 3\cos 2\phi_m)\delta e^2 + \Delta\phi - \frac{m}{\varrho_m \text{ arc } 1''} + v = 0$$

where a is the semi-axis major and e the eccentricity ;

ϕ, in seconds, is the difference of the latitudes of the extremities of the component part of the arc ;

ϕ_m is the mid-latitude of the component reach, here considered short ;

m is the geodetic measure of the component ;

ϱ_m the radius of curvature at the mid-latitude ;

v is the residual of an observation equation.

The most important point, noticeable at once in the equation, is the independence of the coefficient of $\delta a/a$. The coefficient is simply $\Delta\phi$, the astronomical length of the component. The coefficient of δe^2, on the contrary, involves the latitude ϕ_m. This coefficient, $\frac{1}{4}(1+3\cos 2\phi_m)$, has the following values at different latitudes :

Lat.	0°	..	..	coeff.	+1	Lat.	45°	..	.. coeff. $+\frac{1}{4}$
,,	15°	..	..	,,	$+\frac{9}{10}$	,,	54° 44′	..	.. ,, 0
,,	10°	..	..	,,	$+\frac{5}{8}$	,,	60°	..	.. ,, $-\frac{1}{8}$
						,,	90°	..	.. ,, $-\frac{1}{2}$

Now if we consider component parts of an arc in the tropics, we see that the coefficient of δe^2 is very much the same as that of $\delta a/a$. If, then, there are two equations of the form above, in which the coefficients of the unknowns $\delta a/a$ and δe^2 are nearly the same throughout both equations, it is immediately

obvious that the unknowns cannot be evaluated with any precision. The same result appears in the normals formed from a number of equations: the solution becomes unstable. This confirms Mr. Hinks' conclusion that it is not possible to disentangle the correction to the semi-axis major from the correction to the square of the eccentricity, when the component arcs are in the tropical zone.

Again, consider latitude 45°. Here the coefficient of δe^2 has fallen to $\frac{1}{2}$; the weights of the determinations of the semi-axis and the eccentricity may then be taken as 16 : 1. In other words, the eccentricity cannot be well determined from meridional arcs in mid-latitudes. (It may be added that the addition of arcs of parallel makes matters no better.) In higher latitudes a critical point is reached at 54° 44′, where the radius of meridional curvature is equal to the mean of all such radii, that is, equal to the semi-axis major itself. Here the coefficient of δe^2 is zero, and, as Mr. Hinks points out, the semi-axis major is obtainable directly from the measures. At latitude 55°, then, the curvature cannot be determined from meridional arcs.

Hitherto I have considered arcs confined to single zones. The conditions are utterly different when arcs in different zones are *combined*. Thus, a combination of arcs in high and low latitudes will give the best determination of the curvature; in fact, the difference between the coefficients of δe^2 is a maximum, namely, $3\Delta\phi/2$ for equal lengths, when one arc is at the Equator and another at the Pole. I have no doubt that the graphical method will be extended by Mr. Hinks to combinations of arcs in different latitudes and to the inclusion of arcs of parallel.

Time forbids further reference to consequences which might be considered; but I should like to add a tribute to the interesting application of the graphical method to gravimetric surveys. If I may express an opinion, I think that this adds greatly to the value of the paper and demands our admiration.

Mr. H. L. P. JOLLY (Ordnance Survey): Mr. Hinks' elegant method of examining the bearing of the various meridian arcs on the determination of the Figure of the Earth is an example of the great power which is possessed by graphical methods, which convey at a glance certain results which would only be obtained otherwise by a very lengthy study and perhaps not at all. It constitutes also admonition. I will confine myself to that portion of it which is supposed to represent the best geodetic work which has been done, namely, the observations in the United States. Those have a mean date very much later than the bulk of the others. The latitude determinations are very numerous. What, then, do we see on the diagrams representing the United States? Even if we consider the isostatically reduced ones—a procedure to which we may possibly have some objection—what do we find? You will remember Mr. Hinks explained that the determination of the a of the ellipse depends on the general slope of the curve in the diagram, whereas the determination $(a-b)/a$, or flattening, depends upon whether the best line drawn through points is straight or curved and, if so, how much. I think you will find in the diagram representing the United States that the points range up and down by three or four times the sagitta of the supposed curve representing them. The state of affairs as regards the determination in that area of the Earth is that you can determine a combined factor, as it were. If a is so much, then the flattening is so much. You can say it with some certainty. And also if the flattening is so much, then a is so much. I think Mr. Hinks has done service in drawing attention to this fact, not only in regard to the United States determinations but about all previous work.

I do not think these facts were quite noted as they might have been at

Madrid. What did give a great deal of strength to the figure of the Earth which was adopted in Madrid was Helmert's dictum that the best method of determining the flattening was an examination of gravity observations; and, secondly, that Helmert's solution was identical with Hayford's. I am surprised to hear Mr. Hinks say that examination of Heiskanen's observations, of all the gravity determinations to date, shows more agreement with Clarke's figure of 1880 than Helmert's, because I was under the impression that the majority of points were at the disposal of Helmert and *ipso facto* that his flattening, which is identical with Hayford's, would represent the points.

Dr. L. J. COMRIE (H.M. Nautical Almanac Office): I am not a geodesist but rather an intruder here to-day, though I came on Mr. Hinks' invitation because I hoped to see an illustration of a method of attacking a problem, and that is wherein my interest in this particular problem lies. Too often people do not apply common sense to their computations. I congratulate Mr. Hinks on having done so, in spite of his handicap, for I believe he is a trained mathematician. One very frequently sees a trained mathematician taking some figures, deducing a result, perhaps laboriously by the method of least squares, giving the result and a probable error, the latter being several hundred times, and in many cases thousand of times, the unit adopted. The graphical method gives all that the eye can take in. Figures do very little more. If we see a row of eight figures we take in about two, form some mental conception of the two, and ignore the rest. This graphical method, I think, has shown us all that figures could show, and more. Certainly it has pointed out the path for future work.

One point in regard to the table occurs to me, namely, that instead of giving the variation for one per cent. in r it might have been better to have tabulated the variation for one per cent. in n, since the variation is proportional to n and not to r. However, by a little adaptation the tables can be used conveniently.

Mr. HINKS: It is so late that I will attempt to reply only very briefly. Considerable comment has been caused by those two words "if any" in my paper. What I meant by "if any" is not to go quite so far as Sir Gerald Lenox-Conyngham suggests, to wish each country to have a different figure, but I think I would go as far as to suggest that possibly each continent may want a different figure at least for the next century.

Then I have been asked why I have not dealt with longitude arcs. I think I have sufficient excuse in that the one or two longitude arcs which exist—at any rate the most conspicuous, the middle European, has notoriously got something peculiarly wrong with it at one end. I think that until all the longitudes have been determined by wireless it is probably too early to discuss longitude arcs, but I fully agree that it must be done.

Mr. Jolly has asked how it is that Helmert's flattening agrees so precisely with that of Hayford in spite of Heiskanen's results. I cannot answer that fully from memory, but I would point out, at any rate, that Heiskanen has shown that from gravity at stations more or less in the longitude of Europe the reciprocal of the flattening is 1 : 293 or 294, whereas in the United States the results obtained by Bowie give 299 or 300, or even more. There is a vast difference between the results for the United States and for the European longitudes, and of course the result of that is when you put them together and get a general discussion you get about 297, which is sufficiently obvious. But if you look at Bowie's results for the United States you find he does not want a flattening of 297; he wants 299 or 300 at least.

I fully agree with Dr. Comrie that it would have been much better to have

that table calculated for the variation of one per cent. in n instead of r, and if one had known at the beginning what one knows now one would have done so. It was, as a matter of fact, quite a happy discovery that the variation was so very strictly proportional to n that one can actually make transformations with an accuracy of one in the 9th figure or so. I believe Mr. McCaw was as surprised as I was when it came out. It shows only how it is possible to make a happy discovery by pure accident. It did not seem worth while having the whole thing recomputed again, because it was so easy by adjustment to make use of the r variation instead of n. I am sorry now, considering the enormous efficiency of Dr. Comrie's machines and the help they have been able to give, that we did not, as a matter of fact, scrap the r table and recompute the whole thing.

The CHAIRMAN: It only remains for me, in the name of the Society, to thank Mr. Hinks for an extremely instructive lecture. He has endowed Geodesy with a new apparatus which is sure to be increasingly used as time goes on. I was struck with the suggestion made during the discussion that we might have a figure for each continent, and perhaps British delegates at Prague will see that Africa is not forgotten. It might be worth considering whether some figure could be adopted for Africa from a purely practical point of view. I think we all agreed with Dr. Comrie when he spoke of the value of common sense in all these discussions, and we have had to-day an example of a mixture of mathematics and common sense which it would be hard to beat. I beg to thank Mr. Hinks.

METEOROLOGY IN HISTORY

Manual of Meteorology. Vol. 1. **Meteorology in History.— Sir Napier Shaw, LL.D., F.R.S.,** with the assistance of **Elaine Austin.** Cambridge: University Press. 1926. $10\frac{1}{2} \times 7\frac{1}{2}$, pp. xx. + 340. *Plates and Illustration.* 30*s. net.*

THE choice of matter to include in or to omit from this volume, which is the first of four, must obviously depend as much on the scope and purpose of the whole great 'Manual of Meteorology' as on the subject specially marked out for treatment as Meteorology in History, and vol. 1 cannot be criticized as if it were a work complete in itself. The author is to be congratulated on his courage in tackling a tremendous task, the completed outcome of which cannot fail to be a monumental treatise. In the first volume he deals mainly with meteorological theory through the ages, viewing meteorology in history as a forward movement in which the present state of the science is linked backwards with the speculations of Aristotle and the early observations of Dampier, and forwards with the functions of an ideal International College of Meteorology whose cloud-capped towers glimmer somewhere in the future. Such comprehensiveness of view affords ample scope for the method of exposition by relevant digression by which Sir Napier Shaw succeeds in imparting to his students something of his own circumambient mind.

The first inspiring chapter on Meteorology in European Culture is followed by one on the Climate and Weather of the Mediterranean Region as known to-day and another on the measurement of time and the calendar. Chapter iv. returns to the early poets and historians, including references to weather in the Hebrew scriptures, Homer, and Herodotus. Next comes a discussion of

Aristotle's 'Meteorologica' and Theophrastes' 'On the Winds,' supported by long and apt quotations from standard translations and illustrated by reproductions of the eight figures from the tower of the winds at Athens. Chapter vi. is a study of the Variability of Mediterranean Climates in historical times according to the latest scientific views. Chapter viii. drops back to Weather-lore, Astrology and Almanacs from the time of Aristotle to the invention of the barometer, but darts forward at the end to the "new astrology" which takes account of solar radiation and sunspots in our own day. The next chapter, on the Reign of the Barometer as Weather-glass, is the longest in the book. In it the student in search of a consecutive narrative must, no doubt greatly to his benefit, scratch like a fowl in a farmyard, as the bulk of the information is supplied in the form of short biographies of seventy-four men of science, the earliest born in 1561, the latest in 1818, whose work was of vital importance in the development of meteorology. Here, as elsewhere, all foreign quotations are translated into English except some of those in French, which are often lengthy and appear as written. The arrangement of the biographies is chronological according to the date of birth, and the fine index with which the volume is provided proves its value in looking up names of those whose birthdays have slipped the memory. Space is of course tyrannical, but one feels that in a few cases some more facts might have been fitted in and some of Sir Napier Shaw's opinions as to the work of his predecessors allowed to find expression. Still this Who was Who in Meteorology brings together much which it would otherwise be difficult to find, and makes us wish that an extension of it could have been given in the next chapter to carry the record through Victorian times.

These eight chapters bring meteorology down to the era of the synoptic chart and fill half the book. Perhaps more might have been made of the thermometer, including the battle of the scales, and of the development of the rain-gauge and the long fight for uniformity in conditions of observing; but after all that would be more appropriate in a history of practical meteorology than in the introduction to a work dealing mainly with theory. Such a plea would have less force in justifying the surprising omission of direct reference to the immense services rendered by Meteorological Societies and other voluntary associations in the days when meteorology was ignored by the universities and research was not promoted as it is now by government departments.

The second half of the book deals in very satisfactory detail with the rise of international meteorology and the development of the science in the observatory for the surface and the upper air, in the laboratory for the physics of the air, with chapters on arithmetical and graphical methods, on the analysis of air-movement into the general circulation and the cyclone, and a final summary of meteorological theory in history full of fresh light on old problems and with some surprising flashes like that which finds a forerunner of the theory of the polar front in Aristotle.

Sir Napier Shaw takes the world as his meteorological parish and his treatment is essentially geographical, though the use of meteorological maps is but briefly treated. Some geographers may possibly dislike his method of representing the Earth's surface by a composite map on three different projections in five portions, each touching its neighbour at one point only and none of them giving straight rhumb lines or equivalent areas; but the strange scheme has certain advantages.

A reader fresh to the subject might possibly fancy that this work was produced in an atmosphere more official than academic, but he would be dull indeed if he did not recognize through its formal phrases the play of wide human sympathies and the stamp of the strong personality of the author which has impressed itself not only on his writings and on the meteorological service of his country but on the fundamental principles of Meteorology itself.

HUGH ROBERT MILL.

REVIEWS

EUROPE

The Settlements and Roads of Scotland.— Grace Meiklejohn, M.A. Edinburgh: Oliver & Boyd. 1927. 9 × 6, pp. xvi. + 144. 2 *Coloured Maps, Sketch-maps, and Illustrations.* 12*s.* 6*d. net.*

As we learn from Dr. Chisholm's Foreword, and as is also abundantly clear from the contents, this study of the human geography of Scotland is based upon long-continued field-work, as well as upon wide reading of the relevant literature. The distribution of the population, the nature of the settlements, the occupations of the inhabitants, and the lines of communication are studied in four chapters dealing respectively with the Northern Highlands, the Midland Valley, the Central Highlands, and the Southern Uplands. The islands are omitted, the investigation having been confined to the mainland. The fact that of the 134 pages of the book only 32 are devoted to the Midland Valley, in which the bulk of the population of Scotland is settled, bears out the point made in the Foreword that the emphasis is laid throughout upon the diversity of relations which exist outside the coalfield areas, rather than upon the phenomena of industrialization, which present generally similar features wherever they occur. The two beautiful coloured maps, on the scale of 10 miles to the inch, which accompany the book, the one orographical and the other geological, help to make clear the diversity of relief and the associated complexity of geological structure which have influenced so profoundly the human geography of the country. In addition to the coloured maps a number of sketch-maps, mainly town plans, and a fine series of illustrations from photographs, showing both characteristic scenery and types of settlements and dwellings, are included. This lavishness of illustration, contrasting so markedly with the painful economy to which we have become accustomed of late, has been rendered possible partly by the action of the Carnegie Trust in offering a guarantee against loss, and partly, it would appear from the Introduction, by that of Messrs. Bartholomew, who supplied the coloured maps. The result is to make the book an important addition to the comparatively small number of detailed studies of parts of the British Isles already in existence.

The book will, we think, be primarily of value to geographers on the spot, and to those elsewhere who have already a wide knowledge of the country. The method of treatment adopted involves detailed studies of areas regarded as representative, with necessarily summary notes on other regions. This in turn means rapid transitions from one rural area to another, which must make the book difficult reading for those without detailed personal acquaintance with rural Scotland. This applies in particular to the sections dealing with the Highlands, and, despite what has been already said as to the wealth of illustration, we regret that the author has not supplemented those supplied by adding other sketch-maps bringing out points not easily seen on the large maps.

As an example we may cite the description of the road from the Spey valley to the Spean valley (pp. 102–104), which could have been easily made clear with the help of a sketch-map, but is at present difficult to follow. Again, the book begins with an interesting discussion of the shapes and sizes of the parishes of the Northern Highlands. Here a sketch-map is supplied, but it includes no names of any kind, and no form of key is provided, though this would not have been a difficult matter at least so far as the parishes named in the text are concerned. But criticism is perhaps out of place in regard to a book which has obviously been a labour of love, and has been based upon painstaking investigations, carried on over a number of years and in the intervals of other work, and we can but repeat our recommendation of the book to the notice of geographers. M. I. N.

The Mystery of Wansdyke.— **Albany F. Major, O.B.E., F.S.A., and Edward J. Burrow.** Cheltenham: Ed. J. Burrow & Co., Ltd. 1926. 11½ × 9½, pp. viii + 200. *Plans and Illustrations.* 25*s. net.*

Wansdyke, *i.e.* Woden's Dyke, is an earthwork which, it is believed, can be traced from near Portishead, on the Bristol Channel, eastwards as far as Inkpen Beacon, about 8 miles to the west-south-west of Newbury, a distance along the bank of some 80 miles. This earthwork is of very variable relief: in some parts of its course the crest of the bank may be 30 feet above the bottom of the ditch; in others the bank and ditch can be hardly traced, or may have disappeared altogether.

The late Mr. Albany Major, F.S.A., and his friend Mr. E. J. Burrow, devoted much time to an examination of Wansdyke on the ground, and this admirably printed and illustrated book is a record of their labours. Mr. Major unfortunately died during the final stages of the production of the book; and his friend and collaborator tells us that the book is, in a sense, a memorial of Major's life's-work, as he, perhaps "more than any archæologist of the day, had made a special study of Wansdyke, and several times traversed its complete length."

After two introductory chapters, the course of Wansdyke through Somerset is described; then the 14 miles during which Wansdyke runs along the previously existing Roman road from Bath, almost due eastwards; and then to Morgan's Hill and to Savernake. Of this section, near Shepherd's Shore, Mr. Burrow remarks that "it is more imposing in depth and width than at any other place along its whole length." As the dyke ascends the Downs towards Savernake it is very clearly defined, and Mr. Burrow's drawing shows the V-shaped notch on the skyline and the bank on its south side in a striking manner. Then we have a chapter on the course of the dyke through West Wilts, and then an account of its end near Inkpen Beacon, though there is, apparently, no evidence that it ever climbed the hill. An account is also given of an attempt to trace the so-called south-eastern branch, from near Bedwyn to Ludgershall; but Mr. Burrow states that, after careful examination of the disconnected lengths of earthwork along the line in question, he is unable to support the theory that this was a branch of Wansdyke at all.

The greater part of the book is devoted to detailed descriptions of the local topographical details, by which the dyke may be identified in its less obvious portions. The descriptions are accompanied by maps on the scale of 4½ inches to the mile, reduced from the Ordnance 6-inch, and are illustrated by admirably clean and clear drawings, by Mr. Burrow, which are a pleasure to study. Except for some trial diggings undertaken by Mr. H. C. Brentnall and the late Mr. Major, near Marlborough, in 1923–25—diggings with inconclusive

results—the whole examination of the dyke by the joint authors was a surface examination.

But the book contains many pages of useful extracts from the reports of past archæologists, amongst whom General Pitt-Rivers is *facile princeps*. It is to Pitt-Rivers that we owe the only definite information with regard to the date of this great earthwork. In 1889 he dug a section to the west of Old Shepherd's Shore and found, 5½ feet beneath the top of the rampart, an iron knife and an iron nail, and under the outer bank he found fragments of Samian pottery on the old surface line. In another section he found fragments of an iron cleat, on the old surface line; such cleats "formed part of the leather fastenings or sole guards of sandals." These finds, and also perhaps the fact that the dyke for 14 miles makes use of a Roman road, prove that its date is Roman or post-Roman.

To guide us further we have its name, Woden's Dyke, which would seem to indicate that it is pre-Saxon. We have also the fact that the ditch is always to the north of the bank, showing that it was intended for defence against a foe from that direction. Its formidable dimensions, for long stretches of its length, would seem to preclude the idea of its being a mere boundary bank.

These are the main facts about Wansdyke, but no fully satisfactory interpretation of them has yet been put forward. For the writers of the book under review the matter still remained a "mystery," although they were able to make one or two plausible suggestions. Mr. Major looked upon it as a composite structure, not all of one period. He thought that the downland section in Wiltshire might have been intended to close the gap between the Kennet and the Avon valley, and that such a fortification might have been useful during two periods of the Roman occupation. It is certain that it was not thrown up by the Britons against the Saxons, for it was made as a defence against the north.

The problem is a fascinating one, and perhaps one day a solution of it may be found. Meanwhile those interested in it may be advised to study this well-documented and beautifully illustrated book. C. F. C.

Geologische Karte von Europe, 1 : 10,000,000.— Berlin. Gebrüder Borntraeger. 1925. *M.*15.

This very well-executed geological map was prepared by Beyschlag and Schriel in 1925, and Dr. Stille of Göttingen has added to it a transparency upon which the main structural elements of Europe, together with Asia Minor and North Africa, are indicated and named. Twelve graded tints on the base map show the depths of the seas and oceans, while this map also shows the situation of overthrusts, and the maximum limit of Quaternary glaciation. Hence the combined maps afford data in convenient form for tectonic study.

Dr. Stille coins the names Ur-Europa (including Palæo-Europa), Meso-Europa, and Neo-Europa for the three major tectonic units of the continent. The first includes the hypothetical Laurentia, the Caledonides, the Baltic Shield, and the Russian Platform; the second includes the region of the Hercynian fold mountains (here termed Variscides); the third includes the Alpine and associated ford mountains, termed Alpides. With regard to the latter Dr. Stille makes no distinction between the Pyrenees and Caucasus, which are in Argand's terminology *plis de fond*, and those parts of the system which may be designated "new mountains," *i.e.* originating in the geosynclinal of Tethys: nor does he distinguish, with Argand and Staub, the Pennides, Austrides, and Dinarides. The picture presented is, indeed, in accordance with the simple generalization outlined by Kober in his 'Bau der Erde,' of a

mountain system consisting essentially of a pair of oppositely folded *Randgebirge*, which may or may not be separated by *Zwischengebirge*. The Caucasus and Anti-Taurus, for example, here appear as oppositely directed wings of such a system. For an outline study, however, which is all the author presumably has in mind, the absence of detailed analysis of the Alpides is of little moment. A misprint occurs in the spelling of "Variscisches" on the transparency. E. G. R. T.

ASIA

Kings of the Hittites.— **David George Hogarth.** (The Schweich Lectures for 1924.) Oxford University Press (for the British Academy). 1926. 10 × 6½, pp. viii. + 68. *Map and Illustrations.* 6*s. net.*

Dr. Hogarth is, as ever, clear and interesting. In fact, the only point in his book which requires explanation is the title. His lectures were confined to the kingdoms founded or controlled in Syria by Hittite tribes after the twelfth century B.C., and as the Old Testament expression, "kings of the Hittites," is applied exclusively to these he has adopted it as a convenient title for his book. His work at Carchemish has specially qualified him for speaking with authority on the subject, and his classical knowledge on the one hand and extensive explorations in Asia Minor on the other add largely to the value of his conclusions.

Briefly, he believes that after the overthrow of the Hittite Empire in Asia Minor, about B.C. 1200, the Syrian portion of the Empire was occupied by invaders from Asia Minor who established a number of small states, the most important of which was apparently Carchemish. The invaders were known to the Assyrians as the Muska or Moschi, the Meshech of the Old Testament. They must have formed an important element in those "Northern" hordes who, as we learn from the Egyptian monuments, destroyed the Hittite Empire, descended upon Syria and attacked Egypt in the age of the Twelfth Dynasty. The old civilization of the Near East was saved only at the last moment when in a great battle by sea and land the Pharaoh Ramses III. defeated his enemy.

Dr. Hogarth prefers to call the older representatives of the Hittite peoples whose home was in Asia Minor by the name "Hattic," but they were known both to themselves and to their neighbours as Khattâ, Hittites. The name however was geographical, and neither racial nor linguistic. Different races and nations as well as different languages were included under it; the common factor was that they came from Asia Minor, and in early days had been governed or led to victory in Syria and Mesopotamia by Hittite princes. In the days of "the kings of the Hittites" the only state in Syria which could be called Hittite from a purely linguistic point of view was that of the Khatti-nâ in the Plain of Antioch, where the royal names resembled those found at the Hittite capital Khattusas, the modern Boghaz Keui.

Dr. Hogarth's conclusion that the Hittites of Carchemish were Moschians (whom I should derive from the eastern extremity of the Black Sea) agrees with the results of my reading of the Hittite hieroglyphic inscriptions. In these both at Carchemish and elsewhere the kings and high priests call themselves and their subjects "Moschians," and I have therefore proposed to term the inscriptions in question "Moscho-Hittite." That my reading of the texts is in the main correct has now been established by a recently published tablet from Boghaz Keui, in which the same proper name is given in both cuneiform and Hittite hieroglyphics, the two corresponding letter for letter if the values I have long since assigned to the hieroglyphs are accepted.

Dr. Hogarth subjects the artistic monuments of the Hittites in Syria to a close examination, and shows that at least three periods can be detected in them. He also concludes that " the Cappadocian and the Syrian branches of Hittite art were derived independently of one another from some common stock, and that subsequently they developed in independence."

Most of the hieroglyphic texts belong to the same period—the twelfth to the sixth centuries B.C. Those which centred at Tyana (now Bor) form a special group, distinguished by an approach to alphabetic writing. They all date from the seventh century B.C. and partly influenced, partly were influenced by, the contemporaneous Old Phrygian script. The earliest texts yet found are those from Hamath. But I doubt whether we can make the use of incised or relieved writing a test of relative antiquity, as Dr. Hogarth would do. It is true that most of the incised inscriptions we possess belong to a late epoch; but it must be remembered that they are still limited in number, and that our two earliest examples of the hieroglyphic script are incised on the clay tablets of Boghaz Keui.

Those who wish to know what is the present position of the " Hittite problem " from a sane and scholarly point of view cannot do better than read Dr. Hogarth's book, the value of which is much enhanced by the numerous well-chosen photographs with which its pages are enriched.

A. H. SAYCE.

Revolt in the Desert.— **" T. E. Lawrence."** London: Jonathan Cape. 1927. 9½ × 6½, pp. 446. *Illustrations and a Map.* 30*s. net.*

The air of mystery and rumour which attended the issue of T. E. Lawrence's ' Seven Pillars of Wisdom ' some weeks ago to the privileged few who had subscribed for it, and the phenomenal prices at which copies of the work were immediately advertised for sale, naturally generated a very keen interest and anticipation among the less favoured public in the promised issue of an abridged version. This we now have in the ' Revolt in the Desert.'

Not a few of Lawrence's friends and associates of the war had become a little wearied by the stream of gossip, sensational and otherwise, which had been fitfully current during the long period of waiting for his anabasis, and were prepared to be disappointed with the result when it came; but they need not have been. The drama which has at length been unfolded to us is an amazing one; we hear a good deal of " best-sellers " nowadays, but, sensational fiction apart, no book within my memory has been greeted as this has with such frank enthusiasm by every sort and condition of reader. To those of us familiar with the slim boyish figure and seemingly fragile frame of T. E. Lawrence it almost passes comprehension that he should have been able to weather such infinities of moral strain and physical suffering, and have come through the ordeal, if not scatheless in body and mind—that we can hardly believe—at any rate without any permanent symptoms of physical wreck.

Literature is indeed fortunate that the prime actor in this incomparable melodrama of the war should have been possessed of such qualities of style and diction as were worthy of the tale he had to tell. ' Revolt in the Desert ' has been compared to Doughty's classic book of travel ' Arabia Deserta.' I can see no parallel myself, nor can it be said that the style of Lawrence's work, high though it is, is of quite the same quality all through; he is sometimes bizarre, and sometimes seems affected, but there is no lack of fine writing, and some of his word pictures of Arab celebrities who shared his fortunes—Faisal ibn Hussein, now King Faisal of Iraq; Auda Abu Tayi, the grand old warrior of the Howeitat; Tallal el Hareidhin, and his dying war-cry; Nuri Shaalan,

the great Ruwalla chief—will surely leave an indelible impression on the reader's memory.

In the case of a volume so completely fascinating as a whole the wayward eccentricities of the writer in matters of detail will easily be forgiven ; but they cannot be altogether ignored by the reviewer. The variform and capricious spelling of names, familiar and unfamiliar, regarding which we are regaled with an amusing Publisher's Note at the beginning of the book, is needlessly slipshod, and may try the patience of the oriental scholar, but it will probably pass quite unnoticed by the general reader, and need not be taken too seriously. The volume has however one real blemish, to my mind—or, shall we say, inconvenience. We are dealing, be it remembered, with an abridgment of the ' Seven Pillars of Wisdom,' and I could wish that the blue pencil had been more liberally employed in the process. The author seems to go out of his way at times to affect a coarseness, even a vulgarity of expression, which we could well have been spared without the least prejudice to the interest or style of the context. I remember it being said of Emile Zola that he " admittedly wrote with great fidelity, but without any of that reticence or sense of decency which had restrained all previous writers when dealing with mire," and I cannot help recalling that criticism now, though it is not entirely apposite No doubt we live in a less squeamish age than did Zola, but Lawrence's splendid saga of war and adventure would have been ideal pabulum for the sons and daughters of this generation were it not just for this Zola touch. I am fain to hope that in a later edition the inconvenience may be eliminated ; meanwhile ' Revolt in the Desert ' is a book which every grown-up will read with the keenest interest and enjoyment.

A number of portraits are included in the volume—of British officials and Arab celebrities. No two persons ever seem to agree about likenesses, and personally I cannot enthuse about these. To me, certain of them are good ; others perhaps recognizable ; one or two even libellous, to my thinking, and I can but offer sympathy to the victims.

One word in conclusion regarding the author's *nom de plume*—" T. E. Lawrence " with inverted commas ! I believe he is now T. E. Shaw, of the Royal Air Force ; but he was T. E. Lawrence during the Arab Revolt, so surely the *alias* boot should be on the other leg. P. Z. C.

A Servant of the Mightiest.— Mrs. Alfred Wingate. London: Crosby Lockwood. 1927. 7½ × 5, pp. 352. *Illustrations.* 7*s.* 6*d. net.*

Oriental history is notoriously long-winded, and Mongol history stands out in wearisomeness even among oriental histories. Mrs. Wingate has had, therefore, a tedious task in bringing the story of the rise of Mongol power within the scope ot a novel and in presenting it attractively. And she has not always succeeded in her task. There are many exasperating pages which one would fain miss. Yet in the main she does succeed in making us feel the impression which the vast open space, and the clear still sky, and the bracing air of Mongolia must have made upon its inhabitants.

One of the great marvels of history is the way in which an uncultured nomadic people issuing from the steppes and deserts of inner Asia overran nearly all Asia and much of Europe and established dynasties. Here, in the story of Chenghiz Khan, Mrs. Wingate has with great skill and power shown the influence of the steppe life upon the Mongols, how it hardened them and drove them to venture forth, and inspired Chenghiz Khan with a deep and strong religious faith in his destiny. He believed he was a servant of the

Mightiest, commissioned to conquer the world. And he rode forth and very nearly did it. F. E. Y.

Farrer's Last Journey : Upper Burma, 1919–20.— E. H. M. Cox. London: Dulau & Co., Ltd. 1926. 9 × 6, pp. xix. + 244. *Twenty-eight Plates, Sketch-map.* 18*s. net.*

Farrer's last two journeys in search of plants were in the tangle of mountains and valleys around the triangle in Upper Burma, north of the confluence of the N'mai hka and M'li hka, that together form the Irrawady. On the 1919 journey he was accompanied by the author, Mr. E. H. M. Cox. From railhead at Myitkina they marched to Hpimaw, overlooking the valley of the Ngawchang, and from this base explored the country to the west, north, and south, up to the top of the main Salween divide. The range of vegetation from the tropical valleys through the " ferocious " bamboo belts to the alpine meadows is graphically described, and the contrast is drawn between the vegetation of the south-western aspects facing the Monsoon and that of the protected northern slopes.

Farrer had no companion on his second journey, and the story is compiled from letters he sent to the author and friends at home, and his publications in the *Gardeners' Chronicle*. It is pointed out that it is difficult to trace his wanderings later in the year as his letters give no consecutive account, and that later still his letters lack description.

He visited Fort Hertz and finally made his base at Nyitadi on the Akayang, a tributary of the N'maihka and farther north than he had reached in 1919. His main objectives here were the three passes of the Salween divide, the Shing-hong, the Moku-ji, and the Chawchi. His plan was to explore these areas thoroughly and in the autumn collect the harvest of seed from his discoveries during the flowering season. This purpose he was unable to fulfil, for he died at Nyitadi on October 17, after a few days' illness and before he could accomplish the last part of the programme.

Throughout the book the author paints a striking character study of Farrer, his love of what was both his work and hobby, and his enthusiastic interest above all for the Primulas. The general vegetation is pictured as fierce and relentless with " an overpowering strength." As the story draws to its end the reader almost feels the ever-present clouds and mists of these mountains which gradually closed in over the traveller until, at last, they overpowered him and enshroud his resting-place for ever.

The chief interest of the book is for the horticulturist in the series of pen pictures of the plants collected and of their immediate surroundings. The photographs of these and the general views are excellently reproduced.

T. F. C.

AMERICA

The Early History of the Frazer River Mines : being extracts from official correspondence, with an introduction and notes by **His Honour F. W. Howay.** (Archives of British Columbia. Memoir No. VI.) Victoria, B.C.: Provincial Library. 1926. 10 × 6½, pp. xvii. + 126. *Ten Illustrations.*

This work records the sudden birth of a colony, and the close of an epoch. For years the mainland of British Columbia was a preserve of the Hudson's Bay Company, and " Pro Pelle Cutem " was practically the only law. Serious cases were supposed to be tried in Upper Canada, which really meant that they could not be tried at all. Suddenly a mixed mining population poured into the country. Douglas (afterwards Sir James Douglas), the senior Hudson's Bay official, and also Governor of Vancouver Island, decided to represent the

Crown pending authority from England for the creation of a colony on the mainland.

The main difficulty lay in the selection of magistrates, and Judge Begbie, on arriving from England, found some queer subordinates. One of these quarrelled with a colleague over the conduct of a case, and threw prosecutor, witnesses, and his rival's constable—everybody but the accused persons—into the local gaol; for this he enrolled one McGowan, a notorious desperado who had once been elected a Justice of the Peace in California, "where he had attained political power, or rather power politically, by means of the famous ballot box with false bottom and sides." McGowan, however, soon became so amenable to British law that he refused to fight a duel in the Colony, and retired to uphold his honour in the State of Washington.

The rapid establishment of law and order appears, after such incidents, the more remarkable, but here the reader is led by the skilful arrangement of material to draw his own conclusions. Commander Mayne appears upon the scene, and Colonel Moody's Company of Royal Engineers, whose story Judge Howay has written elsewhere. R. P. B.

Medical Report of the Hamilton Rice Seventh Expedition to the Amazon (1924–25).— Harvard Institute for Tropical Biology and Medicine, No. IV. **Richard Strong, M.D., George C. Shattuck, M.D., Joseph C. Bequaert, Ph.D.,** and **Ralph Wheeler, A.B.** Cambridge, Mass.: University of Harvard Press. 1926. *Seventy Plates (including One Map) and several Text Figures.*

The region investigated by the above scientific expedition comprises the greater part of the tropical districts of Brazil. "Portions to-day constitute some of the most unhealthy and dangerous regions to residents, from the standpoint of health, that exist in the tropics." "The region of the lower Rio Branco, from its mouth to the Rio Carrari, is probably one of the worst and most dangerous malarial regions in the world."

The area of the expedition's operations is a large plain completely covered by forest, except at the few clearings for the cities of Pará and Manáos and a few small towns and villages. A very large portion is semi-inundated. The great humidity, the continuous high temperature, and the extraordinary number of biting insects and animal parasites have had such a debilitating and enervating effect that in large areas of territory the population has been almost exterminated. Evidently the health conditions have grown worse, for it is stated that towns said to have once had a population of many thousands with some prosperity are now deserted, the buildings have rotted or been destroyed by the termites, and even the sites are being covered by the exuberant overgrowth of vegetation. The report points out that it is not alone man which suffers here, but that among the fauna generally diseases are very prevalent. Horses, for example, which once were numerous, have extraordinarily decreased in number through the disease called Mal de Caderas, or Quebrabunda—produced by a Trypanosome in the blood. The prevalence of this disease is, it is suggested (p. 93), due to the cupidity and culpable carelessness of human agents.

The report is by no means exclusively medical; there are many pages devoted to zoological and botanical studies. Chapter ii. is devoted to a description of "The Amazon Forest"—its monotony, its gloom and silence, and its treacherous dangers. Nothing in the description invites any but a scientific enthusiast to visit such a land. Many of the figures are beautiful—chiefly the forest scenery. There are two interesting pictures (Plate IX.) of "Ant

gardens" formed by certain *Camponotes* ants, which look like gardens in the air several feet in diameter. There are also interesting groups of the Maku Indians and their dwellings (Plates XIV.–XVI.), but most of the illustrations are distinctly of purely medical interest.

The expedition was well equipped for the latest methods of pathological and biological investigation. Laboratory investigations were conducted at the laboratories of Dr. W. Thomas, the local representative of the Liverpool School of Tropical Medicine at Manáos, and observations were made at the hospitals and clinics at that city and at Pará.

The prevailing and the worst disease is malaria. It is difficult, it is stated, in some parts to find a single individual who does not show signs of chronic malarial infection. Malignant tertian occurs in over 50 per cent. of cases. Spleenomegaly is of course very prevalent. There is a very full discussion (chapter viii.) on enlargement of the spleen generally.

Other common diseases are ulcerative processes of the skin due to various kinds of *Spirochætes*. Tropical ulcer and Leishmaniasis are very common. Tropical sloughing phagedema, due apparently to *Spirochæta Schaudinni*, is far the commonest form of ulceration. This is illustrated by many plates. A newly discovered "Dermal granulomatous spirochætosis" is here described and illustrated. Syphilis is very common and also leprosy. Of the latter a recent report states that in Pará there were 2400 cases, or about one to every hundred inhabitants. The great majority of cases of leprosy are not isolated, and sufferers freely use the public conveyances. A good deal of treatment has been carried out in places, and many thousands of injections of Chaulmoogra oil have been given. Hook-worm disease is very common, and beri-beri, dysentery, typhoid, and small-pox all occur not uncommonly. Yellow fever, once common, is now, thanks to preventive measures taken at Manáos, much less frequent, and relapsing fever and hæmorrhagic jaundice also seem happily to be scarce. One variety of Trypanosome causes chagas disease. We read, too, of stinging ants, stinging and very poisonous black flies, and even stinging caterpillars.

Part II. is devoted to medical and economic entomology, and deals exhaustively with diseases in animals; and Part III. contains observations on the Branco, Uraricuera, and Parima rivers, and includes an illustrated article upon a new tapeworm (*Atriotænia parva*).

It will be seen that this is a book for the tropical specialist and not for the general reader. For the former the book is essential, and the general get-up is so excellent and the abundant illustrations, including many coloured plates of microscopical appearances, are so beautifully reproduced that it forms a most valuable addition to our special knowledge of tropical disease in general and of Brazil in particular. E. W. G. M.

Naturalist's Guide to the Americas.— Prepared by the Committee on the Preservation of Natural Conditions of the Ecological Society of America. Edited by **Victor E. Shelford.** London: Baillière, Tindall & Cox. 1926. 9¼ × 6, pp. xv. + 761. *Sketch-maps.* 45*s. net.*

The Ecological Society of America is a national organization of persons, most of whom are connected with universities or colleges, and all are interested in the preservation of natural conditions. It publishes the journal *Ecology*, which is largely devoted to contributions on the original fauna and flora of America and on their conditions of existence. Ten years ago a committee was appointed to make a list of all preserved and preservable areas in North America in which natural conditions persist. The committee, which now

numbers some seventy-five members resident in different parts of the continent, has accomplished the first part of its task in producing the 'Naturalist's Guide to the Americas.' So far as one can see, the catalogue is complete. We with our few puny acres of Nature Reserves cannot help envying these rich folk their Parks of thousands of square miles. There is a short account of the physiography of each State, Province, or Territory, followed by a general survey of the fauna and flora, together with a complete bibliography, which will be valuable to travellers as well as to naturalists. The numerous sketch-maps are reasonably clear.

Report of the Preliminary Survey of the Mazaruni and Puruni Diamond Fields, British Guiana, March–December, 1925.— H. J. C. Conolly. 13 × 8¼, pp. vi. + 103. London: The Crown Agents for the Colonies. [N.D.] 11 *Figures*, 11 *Maps*.

Diamonds were first found in the Puruni district of British Guiana in 1887 or 1888, but it is mainly in recent years that the output has become of significance in the world's markets. Up to the present over 1,000,000 carats have been obtained, and in 1924 and 1925 the production, whilst less than that in 1923, was about 160,000 carats. The diamonds are all alluvial stones, and are obtained mainly from the Mazaruni and Puruni fields. In the first part of the Report (Introduction, Economic Considerations and Economic Conclusions) it is a little difficult to separate the facts of importance from a mass of generalities and platitudes. In the succeeding section on Geology, which occupies the bulk of the Report, the author appears to be on more familiar ground, and gives a very useful survey of the general geology of British Guiana. There is a fundamental Gneiss-Granite Complex with an associated Volcanic Series, believed to be entirely pre-Cambrian; later intrusive rocks of both basic and acidic types; a Sedimentary Series of unknown age which was deposited along rivers and in the shallower parts of a sea or lake on the peneplaned surface of the basement complex; and the all-important superficial deposits which yield the diamonds. Details are given of the various workings, and the opinion is expressed that there are extensive resources in the proved diamond-bearing area of 1200 square miles. The importance of the diamond and other mineral-bearing deposits in affording a necessary stimulus to general development of the country is emphasized, and it is considered that there should be legislation to prevent careless washing of deposits, even though the annual output should be lessened thereby.

L. D. S.

The Conquest of Brazil: a survey of the land and its people.— Roy Nash. London: Jonathan Cape. 1926. 9 × 6, pp. xvi. + 438. 8 *maps and* 77 *Illustrations*. 18*s. net*.

No one who is familiar with the resources of the vast territory of Brazil will dispute the author's contention that the country may well in the future vie with the greatest in productive importance. Now, however, as in the past, its development is hindered by short-sighted economic policies—*e.g.* that of inter-state export duties—by a ruthless exploitation of the natural resources, and by a lack of sufficient population to colonize the interior or even the coastal regions effectively. Mr. Nash being an American, his remarks on the population question are of special significance. He thinks that Brazil should embark forthwith on an active immigration policy, drawing from all available sources in Europe and Asia. The United States may not always be prepared to act as a benevolent protector. "Who can view the tendency of the United States increasingly to concern herself with the affairs of Mexico and the republics

of the Caribbean, and prophesy what a nation two hundred million strong, in the year 2000, may do if economic power continue to gravitate into her hands ? "

Of the four main sections, supplemented by a full index, into which Mr. Nash's ample volume is divided, the first, which is mainly historical, and the last, comprising four short chapters under the main title of Looking Ahead, are perhaps the best. The author has a flair for the salient features of the picturesque historical setting in which the Brazil of to-day has developed, and knows how to combine the whole into a dramatic narrative. His chapters in the concluding section are from the reader's standpoint all too short, for here he allows his gift of imagination to work freely upon a vast store of knowledge accumulated through wide reading on his subject and through travel and residence in Brazil. The two intermediate sections of the book deal in order with " the essential facts of human geography " and with " some essentials of human happiness." The latter is mainly descriptive, but gives us some new material concerning the domestic life and the social problems of the country. The more or less purely geographical part of the book, however, comprising some 130 pages, or a third of the text, appears to call for some criticism. Though obviously based upon some original observation and on recent as well as older material, the account lacks that discrimination between the essential and the unessential, that soundness and logical arrangement of ideas which contribute to vigour and scientific poise in the finished product. Mr. Nash, in a word, is more fortunate in describing people and their doings than in giving a picture of their environment.

To English readers the author's style is apt to be perplexing. He cannot present anything in simple direct language. His matter is often so wrapped up in far-fetched figures in which American phraseology and allusion abound that a serious disentangling task is thrust upon the reader. Yet at its best the style is graphic and picturesque, and shows what the author can do when he trims his medium to his subject.

E. W. S.

AUSTRALASIA AND PACIFIC ISLANDS

In Savage Australia.— Knut Dahl. London: Philip Allan & Co., Ltd. 1926. 9 × 5½, pp. xii. + 326. *Illustrations and a Map.* 21*s. net.*

The author of this book spent some two years (1894–96) in wild North-West Australia as a collector of specimens for the Zoological Museum of the Norwegian University. On his return to Europe he published an account of his expedition in the Norwegian language, and the issue of a new edition led to the preparation of a translation, done by himself with the aid of two English " supervisors." It may be said that the translation leaves little to be desired, the author's style in a foreign language being noteworthy for its lucidity and accuracy, and being free from any suggestion of the dry-as-dust.

Arnhem Land and Dampier Land were the regions selected for the author's collecting grounds, and he presents to us a vivid picture of the country and its inhabitants over thirty years ago. The conditions have probably not altered essentially since that time, for even then the aborigines had lost much by contact with Europeans and Asiatics, and the author was especially struck by the evil influence of the Chinese. Nevertheless there was still opportunity for the study of aboriginal culture, and although the main object of the expedition was the collection of zoological specimens, the author did not fail to make a number of interesting observations on human life and customs. He was fortunate in escaping regrettable incidents, but if the country was a collector's paradise, the human inhabitants were not angels. The extent to which the

natives had been degraded by civilization varied in different parts, and not everywhere had they become so enlightened as to profit by the sale of the skulls of deceased relatives for flour and tobacco.

The author was very successful in his main object, and he secured and sent home large numbers of specimens, including many new species of animals. His account of his search for a marsupial called " wogoit " by the aborigines, ending in his final success in obtaining specimens of a new phalanger (rock phalanger—*Pseudochirus dahli*), gives a vivid picture of the keen collector on the trail.

Those who are interested in anthropology, zoology, and the climatic and topographical variations in an untamed land will find no dull pages in this book, which is a record of personal experiences from beginning to end.

H. S. H.

The Wild Animals of Australasia, embracing the mammals of New Guinea and the nearer Pacific Islands.— **A. S. Le Souef** and **Harry Burrell.** With a chapter on the bats of Australia and New Guinea by E. Le G. Troughton. London: George G. Harrap & Co., Ltd. 1926. 9¼ × 6, pp. 388. *Illustrations.* 25*s. net.*

Students of Vertebrate Zoology will be grateful to Messrs. Le Souef and Burrell for bringing into one volume a concise account of the mammals of Australasia. In the lay imagination the continent is inhabited only by kangaroos, dingoes, and imported rabbits. The actual population is something like 400 species belonging to seven distinct groups: bats, wild dogs, seals, dugongs, rodents, marsupials, and monotremes. The first five of these groups show near affinities to their relations in other parts of the world, and it is in the last two groups that the most remarkable creatures are found. Though the marsupials have adapted themselves to many different kinds of environment, they have advanced very slowly in comparison with the mammals of other continents where competition was keener. " The majority of them seem destined quickly to disappear, not so much from the opening up of the country and settlement of the land as by reason of the introduction of wild animals from other parts of the world. . . . An Australian animal probably could not establish itself in America; an American animal would be hard pushed to gain a living in Europe, or a European animal in Africa; but reverse the order and we have the avalanche. The case is exactly paralleled by that of the European and the aborigine among mankind." The book is well illustrated with photographs.

MATHEMATICAL AND PHYSICAL GEOGRAPHY

New Dynamical Wave-Theory of the Tides.— [**Captain T. J. J. See.**] Published and sold by the [U.S.] Hydrographic Office. (H.O. No. 207.) 9¼ × 6, pp. 91. *Charts.* 60 *cents.*

This pamphlet, prepared by Captain T. J. J. See, bears the extended title: " Discovery of the physical cause of the variation of latitude, with calculation of the period and amplitude of the polar motion, from the observed oscillations of the unsymmetrically situated ocean hemisphere, including a revised cotidal map of the oceans, now shown to be oscillating in synchronous world-waves coperiodic with the disturbing forces, Laplace's principle, together with an investigation of other laws of the motion of the sea hitherto unknown, and an improved method for calculating the rigidity of the Earth."

To the present reviewer the pamphlet appears to contain no valid con-

tribution to the scientific knowledge of the subjects treated. On the other hand, it does contain many fallacious arguments leading to results which are certainly erroneous. The author appears to have read much of the literature on the dynamical theory of the tides and the variation of latitude, and to have failed to understand a considerable fraction of it. This literature he discusses at some length, and his negative criticisms contain much that is true. But these valid criticisms are by no means new, and, in fact, for a long time have formed a spur to research.

It is a matter of some surprise that such a production could be published under the authority of the Secretary of the U.S. Navy.

J. PROUDMAN.

Treatise on Sedimentation.— **W. H. Twenhofel** and Collaborators. London: Baillière, Tindall & Cox. 1926. 6¾ × 9, pp. xxv. + 661. 61 *Plates and Text-Figures.* 34*s. net.*

This is the work of a committee appointed by the National Research Council (U.S.A.), and it is not surprising that the different sections should be of unequal value. While a geologist may find much to criticize in detail, to a geographer it should prove a valuable work of reference, as it brings together the results of extensive researches which might otherwise never come to his notice. An idea of the treatment may be obtained from the titles of the chapters: "Sources and Production of Sediments," "Transportation, Deposition, Diagenesis and Lithification of Sediments," "Important Conditions [topographical and climatic] modifying Sedimentary Processes," "Sediments and Organisms," "Products of Sedimentation," "Structures, Textures and Colors of Sediments," "Environment or Realms of Sedimentation," "Field and Laboratory Studies of Sediments." Chapter v. forms nearly half of the book, and gives a systematic account of all the various types of sediment: the section on Carbonaceous sediments by Dr. David White may be mentioned as particularly complete and well arranged. Chapter vi. is next in length, and is noteworthy for a very thorough treatment of ripple-marking, mainly by Dr. Kindle; there is also an interesting discussion on the colours of sediments by Mr. Blackwelder. The remaining six chapters are comparatively short. A. M. D.

HUMAN AND HISTORICAL GEOGRAPHY

The History of Atlantis.— **Lewis Spence.** London: Rider & Co. [1926.] 9¼ × 5¾, pp. xvii. + 238. 16 *Plates.* 10*s.* 6*d. net.*

This volume is the third of a series by the same author, the two former being 'The Problem of Atlantis,' reviewed in this *Journal*, vol. **64**, p. 181, and 'Atlantis in America,' reviewed in vol. **66**, p. 466.

In the present volume the author endeavours to give an actual history of Plato's lost continent. He admits in his preface that such an attempt may be considered rather presumptuous. We cannot help feeling that it is so. Mr. Spence has certainly presented a good case, but not a convincing one. In chapter v., "The Geography of Atlantis," he summarizes the data put forward in his former works for the existence of a North Atlantic continent in late Pleistocene time. In doing so he follows M. Termier very closely. Practically no mention, however, is made of the numerous geologists who doubt the existence of such a continent at a time when the Earth was inhabited by early man. The weakness of this chapter upsets the arguments of the remainder of the book.

The author first considers the sources from which Atlantean history may be

derived. The Platonic writings are naturally discussed at some length, as are also those of Diodorus Siculus and other writers who dealt with the question of Atlantis. Plato's account suggests to the author that Europe was invaded about B.C. 9640 from the west. Mr. Spence, referring to the great work of Penck and Brückner, 'Die Alpen im Eiszeitalter,' finds that this date corresponds with the suggested date of the Gsnitsch stadium of the final retreat of the ice. He then goes on to say that the date also agrees with the arrival in Spain of the Azilio-Tardenoisian race, who, the Abbé Breuil believes, came from "circum-Mediterranean" localities. The author indicates certain lines of evidence of their having come by sea from Atlantis.

The remainder, and major portion, of the book is devoted to an historical account of the Atlanteans. Since no such place as Atlantis now exists, the sources of such a history must be derived elsewhere—Western Europe, and perhaps America, to which places the author assumes Cro-Magnon and Azilian man migrated from the former land-mass. By drawing upon what is known of these peoples, together with the writings of Plato and others, Mr. Spence has written chapters on the Kings of Atlantis, the traditions, life, state and polity, and religion of the continent. He is on safer ground when he touches on the animal-life, but is very daring in the two last chapters which deal with Atlantean colonies and the Culture-Complex of Atlantis.

As was pointed out in a review of one of his earlier works, Mr. Spence must first present much more definite evidence of an Atlantis existing in human times before he proceeds to draw conclusions from the supposed spread of its inhabitants. But the value of such a book does not lie wholly in the absolute accuracy of its subject-matter. Whether or not his readers are convinced of the reasonableness of his assumptions, they will all admit that his ideas are interesting and stimulating. J. A. S.

The Acquisition and Government of Backward Territory in International Law.— M. E. Lindley, LL.D. London: Longmans. 1926. Pp. xx. + 377. 21*s. net.*

This treatise is a compendious analysis of the principles governing the acquisition of sovereign rights over land and sea, by means other than those of conquest in war or cession between sovereign states. Little of the World, indeed, now remains for acquisition, and nearly all territories are admitted to be subject to some sovereignty, but the treatise is not on this account of merely historical interest. Questions still arise as to who is rightful sovereign, and these demand the consideration not only of the local facts but also of principles already sanctioned in analogous cases. A notable instance is the recent judgment of the Judicial Committee in the case of the Labrador boundary (*sub judice* when Dr. Lindley's book was published), which has agitated the legal minds of Canada and Newfoundland for more than twenty years. A wealth of legal argument, largely based on analogies, was brought to bear on the interpretation of the word "coasts" in a Governor's commission of 1763, and the decision carried with it jurisdiction over more than 100,000 square miles of territory.

The acquisition by civilized Powers of lands, waste or inhabited by native tribes, is the subject of many of the cases recorded. Effective occupation is required, and claims founded on first discovery alone have been invariably rejected. The difficult cases arise where the occupation has not been continuous. Next may be noted the question whether the subject of a civilized Power can become an independent sovereign; here the leading case is that of

Raja Brooke of Sarawak. He could not and did not wish to divest himself of his status as a British subject, while the British Government strove to avoid the responsibilities of sovereignty. A solution was ultimately reached by the convenient method of Protectorate.

The passages relating to the acquisition of sovereignty over the sea present some problems not yet fully solved. The claims of Spain and Portugal under Papal Decrees, as also those of England in respect of the Four Seas, have long been abandoned: the right to a territorial belt is acknowledged, but the 3-mile limit has become obsolete with the cannon range on which it was founded, and the extent of sovereignty over bays has been settled only in some cases and for some purposes. In regard to commercial rights, the claim of Ceylon to her pearl fisheries, founded on prescription, has been admitted, while that of the United States to an exclusive seal fishery in the North Pacific was rejected on arbitration.

A large portion of the book is rightly devoted to the origin, growth, and powers of chartered companies. Most of the charters were granted in respect of countries having no settled government; they gave powers of occupying the country and exercising all the powers of government. That of the first East India Companies, on the other hand, affecting civilized states, gave monopoly of trade only. The British Government, however, asserted its sovereignty as soon as territory began to be acquired. Nearly all the others have proclaimed the reservation of sovereignty, an exception being that of the North Borneo Company. Here again the British Government strove to maintain an impracticable compromise, under which they could interfere with the administration while the suzerainty remained with the native sultans. This situation also was in a few years terminated by a Protectorate.

Some of the problems stated by Dr. Lindley require more discussion than he has been able to give them. It may also be regretted that in his chapters on "The Exercise of the Sovereignty" he does not describe the mode in which the British Government legislates for its administrative Protectorates. He should have pointed out that the power to legislate for these non-British territories rests, under the Foreign Jurisdiction Act, not with Parliament, but with the Crown alone. This was so in the case of Kenya, Uganda, etc., before they became colonies. In the case of protectorates annexed to British colonies, as in West Africa and elsewhere, the power has been delegated to the Colonial legislatures. As a whole, however, the work shows the results of much patient research, the arguments are well summarized and fairly weighed, while the marginal notes supply references guiding the reader to the sources from which the text is derived. A. G.

GENERAL

Wine and Wine Lands of the World.— **F. H. Butler.** London: T. Fisher Unwin (E. Benn, Ltd.). 1926. 9 × 6, pp. 271. *Illustrations.* 15*s. net.*

Mr. Butler's books always glow with enthusiasm and zest for living. He has a good time wherever he goes and wants his readers to share his enjoyment. This volume is no exception. In a hurried survey he takes us from one vine-growing land to another, telling a little of his personal experiences and impressions and a good deal about the manufacture and qualities of the various wines and spirits. He has a good word to say for all, and even if the book is mainly a series of notes on wines with a few anecdotes thrown in, one lays it down regretfully, wishing it were longer, for it makes cheery reading and is full of sunshine. Some of the chapters are very short, but nearly every alcoholic

beverage gets its share of praise. It is of course a mistake to say that traces of the vine are found in the "earliest strata of the Earth's crust," but the author's enthusiasm for the grape and his desire to give it a long lineage may be gauged from his belief "that the discovery of natural fermentation was the greatest step ever made in the upward progress of the human race." This eulogy of wine includes a number of drinking songs and toasts, a long list of wines suitable for various dishes, and a catalogue of twentieth-century vintages.

R. N. R. B.

To America in Thirty-nine Days.— J. Biggs. The Village Press, Idbury, Kingham, Oxon. [1926.] 8 × 5½, pp. 26. *3s. 6d.*

'To America before steamships' is the alternative title which appears on the cover of this neatly bound booklet that consists of extracts from the diary of Mr. J. Biggs, who went to America in 1837. The extracts are printed *in memoriam* by his daughter. They give a vivid account of the impressions of a man who had no mean powers of observation and criticism. "I dislike the country, I dislike the people, their morals, and their manners," he wrote; but nevertheless he found much to appreciate, and the size and speed of the early steamboats on the Hudson river filled him with wonder.

R. N. R. B.

Goode's School Atlas : Physical, Political and Economic. For American Schools and Colleges.— J. Paul Goode, Ph.D., Professor of Geography, University of Chicago. Chicago and New York: Rand, McNally & Co. 1925. 11 × 10.

In his preface the author says, "Much of the material set down in the Atlas is of fundamental importance in a general education." The claim is thoroughly justified, and indeed we can well imagine the ordinary man, and not merely the student of geography, deriving both pleasure and profit from a study of its pages. The great merit of the Atlas is that it is geographical in the best sense of the word; physical features, climate, vegetation, and political and economic conditions are all represented, and in such a way that from this Atlas alone an intelligent person could learn more geography than from many a more elaborate work. Naturally most attention is given to North America, for which, in whole or in part, there are over one hundred maps. Europe comes next, but, it may be suggested, receives somewhat inadequate treatment.

The maps are as a rule clearly printed, though in some cases at least the colours are not well chosen, and artistic finish is not the conspicuous merit of the work. On the economic map of West Central Europe political frontiers and coal deposits are alike shown in red with somewhat confusing results. The small economic and population maps have been generalized to such an extent that in some cases they are almost deceptive, and we note that on page 68 the population of Denbigh is shown as over 256 to the square mile, while on page 69 it is shown as less than 250. The spelling of European place-names is not quite satisfactory: thus Krakuv is neither the conventional nor the true Polish form (Kraków), nor is it strictly phonetic. The interrupted homolographic projection, on which the world maps are drawn, has never appealed to us, but we like it least on page 15, where South America is split in two.

Notwithstanding some defects the Atlas is a notable piece of work if only for the fact that it is, as far as we are aware, the best which has yet been produced in the United States.

J. McF.

THE MONTHLY RECORD

EUROPE

The Till Valley, Northumberland.

As the type of a Border area, the valley of the Till, a tributary of the Tweed, is studied by Mr. H. Houston in the *Scottish Geographical Magazine*, vol. **43**, No. 2, 1927. The valley is the more westerly of the two lowland routes from England to Scotland which together form the "Cheviot Gate," being separated from the other, along the Northumberland coastal plain, by a ridge of sandstone hills between 450 and 800 feet above sea-level. On the west the valley is buttressed by the Cheviot mass rising to an extreme height of 2800 feet. The geology of the region is complex. There is boulder clay over Carboniferous rocks in much of the valley, but its wide lower part, known as Milfield flat, is alluvial. A large part of the granite dome of the Cheviots is included in the drainage area, and its fringe of rounded porphyrite hills flanks all the upper valleys and sometimes runs out in barren tongues into the richer plain. Rainfall is heavy in the hills, but in the valley itself is mostly below 28 inches a year, which however with the cool summer is ample for agricultural needs. The wetter hill country forms the sheep area, and there is little profitable cultivation above about 350 feet. Though the plainsman is no longer the prey of the hillman, the lives of the two are still essentially different, being separated by a transitional zone between the 400 and 600 feet contours. The Valley land is given up entirely to agriculture, and contains the central market town of Wooler, served by the road to Berwick-upon-Tweed (which relieves the congestion of the coastal road), and also by the railway opened in 1887. Women workers are very general on the Valley farms, and wear a serviceable but far from elegant dress. In the Hill land the life of the people is not much changed from that of a century ago. There are few facilities for transport, and the last 5 or 6 miles of the upland valleys have no made road whatever. The shepherd's house is the typical, and almost the only, dwelling. The shepherd and his family spend the summer herding sheep sent up from some farmer lower down the valley. Sheep migrate with the season, though there is no true transhumance in the Cheviots. In the winter months, when snow sometimes cuts off all communication with the outer world, the people occupy themselves with handicrafts. Taking the Till basin as a whole, the standard of living has been raised in the last hundred years, though the severe conditions have naturally been a handicap. The soil is too poor, and the area too small, to make it of any great economic importance, and there is no stimulus from any adjacent centre of population. Wool is the chief product, and in the Hill land, over fifty per cent. of the whole, sheep-rearing is the only industry. The people are neither English nor Scottish, but a Border folk. The lower part of the valley contains Flodden Field, and the whole was for centuries the arena of conflicts between English and Scots, the latter making much use of the inland route in order to avoid the great fortresses of the coast. In these affrays the Cheviotside Hillmen were ready to join hands impartially with either side.

The Pennines in the Ice Age.

Following on his paper on the early glaciation of Borrowdale, to which reference was made in the *Journal* for July 1926 (p. 90), Dr. Raistrick has dealt in a similar manner with the glaciation of Wensleydale, Scaledale, and adjacent parts of the Pennines in the *Proceedings of the Yorkshire Geological Society*,

vol. 20, Part iii., 1926. As in the former paper, he begins with a useful summary of previous work in this field, afterwards discussing in turn the distribution of drift deposits, striations, and erratics, the moraines and lateral drainage channels, and so forth, and attempting to reconstruct the conditions at maximum glaciation, and the phenomena during retreat. His main conclusions are as follows: In the west part of the area the movement of the ice was in a radial direction from a centre near the head of Mallerstang. It overrode Mallerstang Edge in a north-easterly direction, joining the Shunner Fell ice to cross Swaledale, and in the Greta valley helping to divert the Stainmoor ice from the Tees valley into Weardale. Ice from Baugh Fell and Wild Boar Fell dominated the Rawthey valley, passing north and north-east by Ash Fell to the Vale of Eden, and then over Stainmoor. No ice entered the valleys of the Swale and Ure from the west except that of Baugh Fell, Teesdale, and the Vale of York. The later period of the glaciation was marked by suites of lakes impounded in the tributary valleys by the ice of the main valleys. Terminal moraines in the valleys are associated with definite river-terraces which show the retreat to have been periodic over the whole area. River diversions in the west are merely minor adjustments of the smaller tributaries, but in the east the Swale and Ure, with the Laver, have suffered considerable diversions from their pre-glacial courses. The diversion of the Ure at Masham took place during the glacial period, becoming permanent at its close, while that south of Masham to the Skell was temporary only, during the later stages of the retreat.

Landslides in the Vésubie Valley, Alpes Maritimes, 1926.

The causes and effects of the series of disastrous landslides last November in the valleys of the Vésubie and Paillon de Contes, Alpes Maritimes, are clearly analysed by M. L. Perriaux in the *Annales de Géographie* for March 1927. Though such events are usual in this region, these were on an exceptional scale, and confined with few exceptions to the valley of the Vésubie above St. Jean de Rivière. As the river here runs through Triassic argillaceous and gypseous beds, the slides, but for their rarity in the past, might be attributed to this fact. The inhabitants were inclined to attribute at least two to earth-tremors, but these were neither unusually severe nor frequent. The main cause must be found in the torrential rains of the weeks preceding November 21–24. At Nice in the previous thirty-one days 441 mm. had fallen, compared with the monthly average of 137 mm. for October and 97 mm. for November. At Venanson, at the head of the Vésubie valley, 1200 metres above sea-level, about 1662 mm. fell in the same period. This very nearly equals the average annual rainfall for that station. The worst catastrophe occurred at Roquebillière–Belvédère. Roquebillière lies at the foot of a hill of Triassic clays capped with morainic material. Above this hill the valley slopes steeply to Belvédère, the last stage having an incline approaching 45°. Here crevices appeared, and the landslip took place, precipitating two million cubic metres of viscid mud, clay, and erratics upon the village. The face of the slip was 2·50 metres high. The crevices had been noticed and warning given, but unfortunately the inhabitants had returned to their houses, eleven of which were destroyed and nineteen persons killed. Further rains filled the basin formed by the slip, and several days later the accumulation brought down cultivation-terraces and trees into the river. These terraces had been undermined by persistent excessive irrigation during the dry season. The features of the other slides were similar, the

saturated sub-soil sliding over the underlying steeply sloping beds. In the valley of the Madone de Fenestre, the slopes, saturated by the irrigation canal, slipped across the torrent itself and tore up the farther side, forming two lakes, which, though the torrent soon made its way through the obstruction, still existed a month later. A lake was also formed at La Muselle in the bed of the Vésubie, and was still 2 metres deep in December. The social and economic effects were serious: besides the loss of life, and damage to property, roads and tramways have been destroyed and much valuable cultivated and terraced land and timber have been lost. Moreover, the inhabitants of this inhospitable region are losing heart and emigrating to the Côte d'Azur.

AMERICA

Utilization of the Waters of the Great Lakes.

The complex question of the utilization of the water of the Great Lakes for various projects is discussed by Mr. Philip W. Henry in the *Geographical Review* for April on the basis of two reports. The first is by the Engineering Board of Review of the Sanitary District of Chicago, the second by the Joint Board of Engineers appointed by Canada and the United States to consider the St. Lawrence deep waterway (1927). Under the Boundary Water Treaty of 1910, Canada was permitted to utilize 36,000 cub. feet per second at the Niagara Falls, and the United States 20,000 c.f.s. This difference is said to have been made good by the insertion of a clause designed indirectly to cover the 10,000 c.f.s. which Chicago was then diverting from Lake Michigan.

The water diverted at Chicago is employed for three purposes: sanitation (water supply and sewage disposal), transport, and power development. To preserve the lake from pollution the sewage, after dilution with seven times its volume of lake water, is discharged by a canal into the Des Plaines River and ultimately into the Mississippi. After considerable litigation, Chicago, under a permit of the War Department, now takes 8500 c.f.s. from the Lake for dilution, and is required to build further treatment works and to reduce the amount taken for water supply, 1200 c.f.s. (This gives the high figure of 280 gallons per head daily.) The Engineering Board considers that until these further works are carried out the health of the population of the district, 3,426,000, requires an average annual diversion of 10,000 c.f.s.

The diversion canal is also a part of the "Lakes-to-Gulf" waterway, forming when further improved a 9-feet bargeway to Utica on the Illinois River. The section between Lockport and Utica, though possible without water diverted from the lake, would, it is said, cost $30 million more than with a diversion of 10,000 c.f.s. It is further stated that "the actual monetary value of a cubic foot of water per second for power purposes in Illinois is greater than at Niagara." This may be so, but it does not remove possibilities of hardships at that end. The statement that two-thirds only of the net power available is produced at Niagara is also open to question. Regarding the St. Lawrence, the Chicago diversion is 4 per cent. of its total flow. The other States and Canada fear that thel owering of the levels of the Lakes will affect transportation, for the reduction of a foot in the draft of a freighter would mean a loss of $6 million dollars per annum for the entire fleet. The Engineering Board of Review estimates that without remedial works the diversion of 10,000 c.f.s. will lower the level of the Lakes permanently, the greatest difference, in Lake Michigan, not exceeding 6 inches; the Joint Board calculates that the diversion of 8500 c.f.s. lowers Lake Michigan 6 inches. Undoubtedly, however, during the last decade the lake-levels have fallen

below the average: the mean levels are 2½ feet lower than six or eight years ago, while the Michigan level is 4 feet lower than it was thirty-eight years ago. This is partly connected with the decreased rainfall and the greater evaporation since 1917, and is not likely to be permanent. The regulation of Lake Superior, the dredging of the St. Clare and Detroit rivers, the Welland and other canals account for the rest. The Joint Board recommend compensating works to remedy the Chicago diversion by restoring the levels of Lake Huron and Erie, at a cost of six million dollars. Some notes on the St. Lawrence deep waterway were given in the *Journal*, **66**, 380–1: it is estimated that to provide a 25-feet channel on the Great Lakes and St. Lawrence would cost $212 million, excluding the cost of the New Welland Canal, $114 million, already in course of building, and without power development.

POLAR REGIONS

Protection of Fauna in Spitsbergen.

A proposal for the establishment of a national park in Svalbard (Spitsbergen Archipelago) to protect the animal life has been brought forward by Mr. A. Hoel of Oslo University, and is summarized in the *Norwegian Trade Review*, No. 1. Two difficulties arise at once: the inadequacy of the probable means for controlling so large an area, and the traffic already established in bear and fox furs, eider down, etc. The inhabitants now number from one to two thousand, and as the limits of expansion cannot be determined, the protective measures must be temporary. It is proposed that the hunting of reindeer by dogs or taking them in traps or snares shall be unlawful, also the use of poison or explosives in hunting or fishing. At the present time the reindeer are protected for a period of ten years. A close season is recommended for eider duck, and the protection of certain colonies for three years. Polar bears have suffered heavily of late, but as it is thought impossible to prevent them being shot by sealers during the summer, it is advised that hunting during the winter should alone be regulated. For similar reasons, the Arctic fox could be protected from tourists and others only during the time its pelt is worthless to trappers. As whaling would become profitless before the whales were totally exterminated, it is not necessary to protect them. It is also recommended that North-West Spitsbergen, between Ice Fiord and Dickson Fiord, should be declared a natural park, and all hunting and collecting prohibited there. This area contains the volcanoes and hot springs of Wood Fiord. Such regulations would of course be modified for scientific expeditions.

MATHEMATICAL AND PHYSICAL GEOGRAPHY

River-Problems.

In vol. **20**, pp. 301–325, of the *Proceedings* Yorkshire Geological Society Prof. E. J. Garwood's Presidential Address on "Some Problems of River Development" is printed. The author deals with some questions not often considered in English papers. He discusses amongst other matters the effects of the rotation of the Earth on river development, and reaches the conclusion that while this is an influence which may cause rivers to migrate laterally, its effects are often obscured by other and more important factors. But the chief problem with which he is concerned is, "Why do tributaries so often enter the main stream on the concave banks of the meanders?" He discusses the views of various writers on this subject, and reviews a good many cases illustrating this point. Prof. W. M. Davis writing on this subject concluded:

" Any river we now see meandering in an alluvial plain must have been already meandering a long time. Its individual meander curves must have advanced down the valley over considerable distances, and it is, I believe, chiefly for this reason that tributaries are taken in where the main stream bends towards them." Prof. Garwood agrees with this view in so far as large river meanders are concerned, but, as in the case of the River Mite, to the east of Wastwater, notes that it is not a complete explanation. The several small tributaries flowing into the Mite are all steep and their thalwegs are cut in drift. " As the main stream passes each of these tributaries it is deflected towards their mouths, so that they enter on the concave bank of each loop." In this case the tributaries themselves seem to have influenced the deviations of the main stream. The subject River Development was chosen because in 1924 Prof. Kendall in an address to the same Society suggested an investigation of the Yorkshire rivers by members of the Society. Students will find the paper very suggestive, and its value is enhanced by the addition of a useful bibliography.

A Humidity Map of the World.

In a recent number of *Petermanns Mitteilungen* (1926, Heft 7–8) Dr. Paul Hirth, of Görlitz, produces a coloured map of the world, with explanatory text, showing the distribution of humidity in relation to the necessity, or otherwise, for irrigation. The meteorological index is the quotient of mean annual rainfall in millimetres divided by mean annual temperature in degrees C., which is called the " Rain Factor " of a place, a correction being applied in the case of mean annual temperatures below 0°. The rain-factor of 40 is taken as the boundary between a dry and a humid climate. Tables are given of rain-factors for a large number of places all over the globe, places on the map having the same factor being described as lying on the same " isonotide " (from the Greek *νοτίς*, moisture). The sub-tropical desert belts all have a factor between 0 and 20, whilst portions of the equatorial regions on the one hand, and cool temperate or cold latitudes on the other hand, have a factor over 100. In the British Isles, Scotland, Ireland, and Wales are over 100, most of England and Central Europe under 100, London being given as 62. Of this map it may be remarked that, if it be taken strictly to represent how different countries compare in relation to the water requirements of crops and nothing more, it will prove instructive, but that it is wholly misleading if the rain-factors are interpreted in any wider sense. " Dryness " or " dampness " of climate is not the simple thing that this map would represent. A physiological dry or humid climate is a complex effect of amount and frequency of rain, frequency of fog, vapour pressure, and condition of soil. This effect is numerically indeterminate, but the nearest approach to a numerical expression—the best index of this totality of influences—is given by the ratio of rainfall to evaporation, not the relation of rainfall to temperature. It is anomalous, for example, to find, on the basis of the " rain-factors " in question, that countries like Siberia and Canada, which with their covering of dry crisp snow and low vapour pressure are commonly regarded as representing the type of a physiologically dry winter climate, are classed among the dampest regions on earth, whilst England with a distinctly damp type of winter climate, as denoted by relatively high vapour pressure, water-logged meadows, and common alternations of rain, fog, and wet snow, figures on the map in a less humid zone.

HUMAN AND HISTORICAL GEOGRAPHY

Italian Map Collections of the Sixteenth Century.

The collection of Italian maps brought together by Antonio Lafreri of Rome in the second half of the sixteenth century has attracted wide attention, and there has been a tendency to neglect other Italian collections of about the same date, or to wrongly associate them also with Lafreri. Detailed accounts of two such collections have now appeared almost simultaneously, the one contributed to *L'Universo* of March 1927 by Prof. Almagià, the other issued by Messrs. Quaritch as a description of a volume of the kind offered for sale by that firm at £1000. The two collections are generally similar, but that discussed by Prof. Almagià is by far the larger, containing 137 maps as against the 52 of Quaritch's. It had been briefly described by L. C. Moser in 1891, but had escaped general notice, and some search was necessary before the present whereabouts of the volume could be discovered. Its history is of some interest, as it had belonged to the well-known Italian geographer Adriano Balbi, by whose son it was presented to the then Austrian Lloyd, now the Lloyd of Trieste.

The collection is remarkable for its wealth of *geographical* maps as against the views and plans which form a large part of others of the time. An unusual number too—eight in all—are planispheres, and the volume is particularly rich in maps by Giacomo Gastaldi, including those most rarely met with. Like the Lafreri Atlas, it includes maps of many different sizes, some folded, others originally so small that wide margins have been pasted on to bring them to the size required for binding together. But there is no doubt that the set has come down in its original form, probably as it was brought together for a client of the firm which supplied it. It is equally certainly Venetian, for not only do most of the maps bear the names of known Venetian engravers, publishers, and booksellers, but the paper used bears in the great majority of cases watermarks used by Venetian paper-makers. In his detailed list Prof. Almagià mentions the watermark of all the maps which bear one, that most represented, both on the maps and the marginal strips, being No. 56 of those figured in this Journal in May 1924. The name which occurs most frequently is that of Ferrando Bertelli, whose well-known shop was at the "Libreria del S. Marco in Merceria"; others being that of Camocio (who carried on business "al Segno della Piramide") and Furlani (who appears as engraver, but who also had a shop "al Segno del Nave"). The names appear on some of the maps in association, and from the evidently close relations maintained by Bertelli and Camocio it is possible that the collection was a joint venture of the two. It includes also some maps published at Rome (some by Lafreri), just as the Lafreri collection includes items by Venetian cartographers.

An analogous but smaller collection, hitherto little known to students, is also preserved in Italy—at the Communal Library at Treviso. It contains 73 maps, of which 49 are exactly the same in the two collections, while 9 others differ in small points only. The same paper is used for the marginal strips, and many of the watermarks on the maps themselves are the same too. The Quaritch collection, though containing only 52 maps, is complete in itself, for it embraces a systematic selection of maps of all parts of the world. The watermark No. 56 is found here also, but not often, the commonest being an eight-spoked wheel. Like the Trieste volume it includes Gastaldi's big map of Africa of 1564 (properly in 8 sheets, of which one, embracing part of the Southern Atlantic, is here missing) reproduced by Nordenskiöld in his 'Periplus'; and it also includes a large wall-map of Europe, hitherto virtually

unknown to students, by Giovan Pietro Contarini, in 15 (out of 16) sheets. The only other known copy of this last is in the Biblioteca Alessandrina at Rome.

Prof. Almagià points out that, with the exception of one map dated 1570 in the Trieste volume, none of these three collections contains a map of later date than 1569; he therefore concludes that the Venetian publishers were supplying them to clients in 1569–70. (He notes that certain maps known to have been re-issued in 1572 and 1573 bear here the original dates between 1566 and 1569.) As all the known copies of Lafreri's Atlas with title-page contain maps of after 1570, he is inclined to credit the Venetians with the priority in this sort of enterprise, though he allows that Lafreri may have supplied his customers with miscellaneous sets of maps before the title-page was thought of. It thus would seem that Ortelius was anticipated by his Italian rivals in the idea of issuing such a general collection, though he no doubt surpassed them in his judicious choice of the maps composing it.

In a special note on Gastaldi's unique world-map of 1569, which forms No. 6 of the Trieste collection, Prof. Almagià gives reason to conclude that it is a re-issue by Camocio of an earlier map, now unknown, published before 1562 and referred to in Gastaldi's brochure of that year. As it represents the Strait of Anian, between Asia and America, in precisely the same way as in Zaltieri's often-quoted map of 1566, it is almost certain that, as was suggested by Marinelli (cf. *Journal*, **50**, p. 307), that representation was merely copied by Zaltieri from Gastaldi.

Prof. Almagià's list of maps in the Trieste volume gives references throughout to previous lists (by Castellani, Nordenskiöld, Wieder, and Phillips) in which the same maps occur; the Quaritch list refers to the Phillips list (of maps in the Library of Congress Collection) and to that of Nordenskiöld, with occasional references to similar maps in the British Museum. Certain of the maps in the Quaritch list, of which it is there remarked that no other copies had been traced, occur also in the Trieste volume, the description of which had not appeared when the Quaritch list was printed. But its compiler has also overlooked the fact that several of the special rarities, *e.g.* Gastaldi's big map of Africa, are to be found in the British Museum.

GENERAL

A New Magazine.

The first number of 'Antiquity: a Quarterly Review of Archæology,' appeared in March last, edited by Mr. O. G. S. Crawford of the Ordnance Survey and published by John Bellows, Gloucester. The annual subscription is £1. The Editorial Notes setting out its aims state that it "will attempt to summarize and criticize the work of those who are recreating the past: . . . our field is the Earth, our range in time a million years or so, our subject the human race." In this wide sphere, there will be scope for the geographer as well as the aviator, astronomer, botanist, and other scientists specifically mentioned in the Notes. The nature of the contents will be made clear by a brief survey. Mr. Crawford gives an account of his examination during low spring tides of stone walls of human construction in the Tresco and Samson flats of the Scilly Islands. Similar prehistoric stone walls are found on the island of Bryher, and their existence points to a land subsidence in recent times, probably gradual, not catastrophic, but nevertheless the basis of the Lyonesse legend. This article is illustrated by air photographs, and the value of these in archæology is further shown in an account by Mrs. H. E. Cunnington of the discovery of a "wood circle" near Durrington Walls. From the ground

this circle was taken to be a mutilated disc barrow, but aerial photographs and subsequent excavation revealed six concentric circles of holes, which once held posts or trunks, within a wide ditch and bank. Its similarity from the air to Stonehenge led Squadron-Leader Insall, V.C., to photograph it and to draw the attention of archæologists to it. A similar circle has recently been excavated in Holland, at Harendermolen, near Groningen. An article with more geographical interest is contributed by Mr. V. Gordon Childe on "The Danube thoroughfare and the beginnings of civilization in Europe." Before the Alpine passes were open, while much of Central and Northern Europe was covered with forest, the Danube offered a way of penetration for the Ægean civilizations into Central Europe. Its supplies of fish induced explorers to sail up it and to discover the loess deposits suitable for settlement and particularly the mineral wealth of Transylvania, Bohemia, and elsewhere. Research has shown fundamental relationship between these settlers and the people of the Ægean, especially of Troy. In this way, as the loess lands of Moravia, and afterwards of Central Europe generally, were opened up, neolithic culture extended from Galicia to the Rhine valley. When Troy II. flourished, a close connection was maintained with the Middle Danube, and Bohemia may have been one source of tin for alloy. The fall of Troy about 1800 B.C. and the opening of the Brenner led to the isolation of this region, but a local bronze culture (Aunjetiz) flourished in Bohemia and Thuringia.

Among the remaining contributors, Mr. A. P. Trotter, discussing Stonehenge as an astronomical instrument, after analyzing Sir Norman Lockyer's work, concludes that as an instrument for the settling of dates it cannot have been very successful, and that its real purpose is still conjectural; Mr. R. C. Collingwood gives an account of the alterations in position and character of the Roman frontier in Britain; and Mr. R. Firth describes Maori Hill-forts. It will be seen that the contributions are varied, and they all are clearly written.

The Forerunners of Hakluyt.

The sudden burst of activity in many spheres in the Elizabethan Age, almost unheralded in previous decades, has been remarked upon by historians. Mr. G. B. Parks, in a contribution to *Washington University Studies*, vol. 13, seeks to show that in geographical science, likewise, England had shown little interest for years in the deeds or accounts of discovery, and that Hakluyt's great work marked an unprecedented advance in geographical literature. Scholars like Erasmus and Moore had encouraged the study of geography, but as students of the classics rather than of the modern world. Previously Caxton had printed Higden's 'Description of England' and the 'Mirror and Description of the World' of Vincent of Beauvais, but their practical value was not great, as might be said also of Mandeville. Later, the Spaniard, Vives, who came to England as tutor to Princess Mary, recommended the study of the amended maps of Ptolemy. Here, as elsewhere, the impetus was foreign. In actual navigation and discovery much was owed to the Cabots, for example, and to the works of Verrazzano and Roze. One English writer, John Rastell, however, showed a less superficial interest in geography, and his 'Interlude of the Four Elements,' a curious outcome of an abortive expedition to Newfoundland about 1516, added to the general knowledge of the new world. But the turning-point came with the founding of the Russia Company in 1555, which again owed much to Sebastian Cabot. Knowledge of navigation and of distant countries was now greatly desired, and a translation of Cortes'

'Art of Navigation,' and Cunningham's 'Cosmographical Glasse' appear on the one hand, and on the other Eden's 'Decades of the New World,' a compilation from Peter Martyr with additions. Mr. Parks concludes with a list of English books on geography prior to Hakluyt, which shows the superiority of the latter's work, though it too was largely a compilation from foreign sources. Here, also, the scientist was meeting the demands of the practical man, rather than directing his further course.

OBITUARY

Dr. Walter Leaf

GEOGRAPHICAL interests and distinctions were by no means the only ones, or indeed the chief, that Dr. Walter Leaf could claim. He was by predilection and training an exact scholar, with a fine taste for beauties of literary style, as he showed so long ago as 1882 by his collaboration with Andrew Lang and E. Myers in a famous version of the 'Iliad,' and more lately by his 'Little Poems from the Greek.' By adoption and application he became so good a man of business as to be chosen to fill the parts of Chairman of the Committee of the London Clearing Banks, President of the Institute of Bankers, and Chairman of the Westminster Bank; and it was this business qualification as much as the scientific that commended him, after having been a member of this Society since 1898, for election to the Council in 1924. But his study of a particular province of ancient geography, to which he was led by early Homeric studies, was most congenial and thorough-going, and promised to lead him into wider fields than the Troad before the War nullified his project of producing, with a body of collaborators, the long-desired edition of the whole text of Strabo with geographical commentary. He was not deterred, however, from continuing his own special studies and putting out their results in his 'Homer and History' (1915) and 'Strabo on the Troad' (1923). Into these books he may be said to have collected all about the north-west corner of Asia Minor that the future editor of Strabo will need to know. Of other services to science and letters and to archæology (particularly to Hellenic studies) and scholarship, it can only be said here that they were far greater than are represented by his literary output. Few scholars during the past forty years have not owed something to his acumen, learning, and encouragement; while of his generous help to the causes and individuals that interested him, ten times more could be written than he would ever have wished made public. A man of strong preferences and some prejudices, and now and then ungracious in controversy, he responded readily to genuine enthusiasm, and always allowed the public interest to overcome in the long run any personal feeling. His combination of capacities and of qualifications will not easily be repeated. D. G. H.

Dr. Charles Doolittle Walcott

We record with deep regret the death, on February 8 last, of Dr. C. D. Walcott, Secretary of the Smithsonian Institution, and an Honorary Corresponding Member of the Society since 1916. Dr. Walcott was born in Oneida County in 1850, a descendant of seventeenth-century immigrants from Shropshire. His interest in geology and fossils was early aroused, though it was not until he was twenty-six that he was able to devote himself entirely to

scientific research. His first post was assistant to Prof. James Hall, then, in 1876, State Geologist of New York. Three years later he entered the United States Geological Survey, beginning work in southern Utah and Colorado, and later investigating the Palæozoic rocks of Central Nevada. He also undertook in addition the identification of the Palæozoic fossils in the Museum at Washington. He was Director of the Survey from 1894 until 1907, when he was elected secretary of the Smithsonian Institution. In both these offices he displayed much administrative ability without neglecting his scientific studies. As Director of the Survey he had also evinced a far-sighted and fruitful interest in the development of forestry and reclamation. His greatest achievement was the finding of impressions of soft-bodied organisms, primitive crustaceans and the like, in the Algonkian and Cambrian formations, a considerable addition to the knowledge of the dawn of life on the Earth. Amongst many academic distinctions, Dr. Walcott was President of the National Academy of Sciences from 1917 to 1923, a foreign member of the Geological Society of London (from which he received the Bigsby and Wollaston Medals), and a Corresponding Member of the Academy of Sciences, Paris.

CORRESPONDENCE

Mawenzi

MAY I take the liberty of correcting a mistake which appears in Mr. Gilman's note on Dr. Latham's article in the December number of the *Geographical Journal* on page 505? It is there stated that G. Londt climbed Mawenzi in 1925, and from the context it might be assumed that this ascent was a complete ascent to the highest point. This is not correct. Mr. Gilman has unfortunately been misled by the newspaper reports of Londt's climb. Londt, in an official statement to this club, does not claim to have climbed Mawenzi itself, but only a minor peak thereof. Reference may be made to the November number of the *Alpine Journal*, page 345, where a correct statement of Londt's climbs appears.

KEPPEL H. BARNARD,
Hon. Secretary.

The Mountain Club of South Africa,
Capetown.

From Burma to Assam by the Kronjong Pass

I HAVE just seen in the *Geographical Journal* for March that Mr. F. K. Ward has done me the honour to criticize the brief account of my journey which appeared in the *Journal* of last July. The letter from which this account was extracted, was written hurriedly on the train without any idea that it would be published, and still less that it would be subjected to meticulous comment. Mr. Ward infers that a path *does* exist up the Nam Yin and the Nam Kampi and that it "is used regularly by the Mishmis, . . . to fish in the headwaters of the Mali Hka." Although a path did exist up the Nam Yin to a point about 2 miles above the junction of the Nam Kampi and the Nam Kamyang, it went from the now non-existent village of Nam Kabat and was kept open by the Shans. It has not been used for many years and at present no trace whatever remains of it, and it is necessary to use the bouldery bed of the torrential stream where possible, and where not, to cut a way through

the tangled jungle. It is quite common knowledge in and about Hkamti that the Kronjong Pass was used for generations, partly by the Mishmis but chiefly by the Shans. This is now however largely a tradition, as the route (not *path*) has long been abandoned, first because the Shans who kept it open, now go *viâ* Myitkyina and Mogaung and the Hukawng Valley; and secondly because the musk-deer, which was the Mishmis' object rather than fishing, has become scarcer. The Shans of the Nam Kiu monopolize the fishing, and there are no fish in the Nam Kampi and none in the Nam Yin above the Longlin pool, some 3 miles above the Mali Hka. To indicate the nature of the "going" by the Kronjong route I may say that, on dismissing my carriers in Assam, not one of the twenty, comprising four different tribes having no interests in common, elected to return by that way. All took much longer but easier roads.

Mr. Ward's opinion that my difficulties were due to the season and an unusually wet spring is incorrect. Though from 15 March to 9 April 1926 there was, I believe, a wet spell in the region round Sumprabum, far to the south, I think I am correct in saying that the records kept by Dr. Pardee in Fort Hertz show nothing abnormal in the weather at Hkamti during that period, and during the last week before I left for the pass we hardly had a single drop of rain. Before we reached the upper Kampi, though we had almost daily showers and mist *en route*, the snow had entirely disappeared from the south-east side of the pass. As a matter of fact, these steep mountain streams vary diurnally rather than seasonally, except of course where there is much snow, and the time of year chosen for my journey, *i.e.* between the melting of the last snows and the coming of the wet season, was, as every one in those parts realizes, the most favourable for such a journey. In any event it was the *only* time at which it would have been possible to secure coolies who would face it.

Now as to the interesting subject of the Ghalum and the Zayul Chu (let us drop the name "Krawnaon," as it is one little if ever used in referring to this river). So very few Europeans have seen the junction that exact information would have been of more interest than the mere remark that my statement that the Zayul has not so very much more water in it than the Ghalum was "astonishing." There is, of course, no question as to which of the two rivers is the *chief* source of the Lohit; this has long been established in favour of the Zayul, not only on account of its much greater length, but because of its predominance in volume throughout the bulk of the year. The Zayul Chu has an approximate length from source to its junction with the Ghalum of 100 miles, in which, or in at least 95 miles of which, it drops at the utmost 7000 feet, an average grade of 70 feet per mile. The Ghalum in its much shorter course, probably not over 30 miles, falls some 12,000 feet or 400 feet to the mile. In its last 15 miles above the junction, the Zayul has a grade of only about 30 feet to the mile, while in the same distance the Ghalum's gradient is 200 feet per mile, or nearly seven times as great as the Zayul! This latter figure is from my own instrumental observations. Moreover, for nearly the upper quarter of its length the Ghalum actually lies amid huge and almost inexhaustible snow-fields, and the period when the extreme gradient of this river would so largely assist in augmenting its contribution would be when these fields were melting and providing unlimited supplies of water at its source. It was at this precise moment that I traversed the river and that I photographed its junction with the Zayul Chu. My own careful observation was that in April there was little difference in width, though possibly the depth of the Zayul was greater, but allowing for the much greater speed of the Ghalum, my remarks were, I consider, entirely justified The aspect of these two rivers might be changed in

winter, with the sources of the Ghalum frostbound, and its steep gradient of little use, while the Zayul, flowing throughout its greater length in comparatively low altitudes, would continue to discharge more nearly its usual volume. The comparatively wider valley of the Ghalum and the Lohit (called in its upper part the Tellu) are obviously, at this point, geologically one, and clearly carry the same river without change in course, while the Zayul enters through a much steeper and narrower gorge (probably of more recent origin) and at almost exactly right angles to the combined Ghalum and Tellu.

And finally, to take up his first criticism last. A full half-page has been devoted to my statement that I found the Mishmis (I refer to the Mijus and Taroans, not to the Digaru Mishmis, as he assumes) quite manly, reasonably friendly, and hospitable, contrary to certain previous reports. My reference was not to the accounts of any of the people he mentions, but to another expedition in which, in my humble opinion, sufficient consideration was not given to the wretched conditions under which these poor people exist, in the strictures made against them.

D'ARCY WEATHERBE.

Peking, 29 March 1927.

Mr. F. Kingdon Ward writes in reply:

In 1922–23 a number of Mishmis came over the Krongjong Pass, and I met them fishing in the Nam Yin, and bought fish from them. I was told that they came every year, but perhaps they have now ceased to come.

No doubt the Ghalum, as Mr. Weatherbe says, in spring does at first sight look nearly as large as the Zayul Chu; but it did not seem appreciably to increase the volume of water in the main stream in December. But is it not somewhat strange that this Ghalum, with its "unlimited supplies of water," its immense descent, and its assumed greater age, has not worked nearer to the base level of erosion?

MEETINGS: ROYAL GEOGRAPHICAL SOCIETY: SESSION 1926–1927

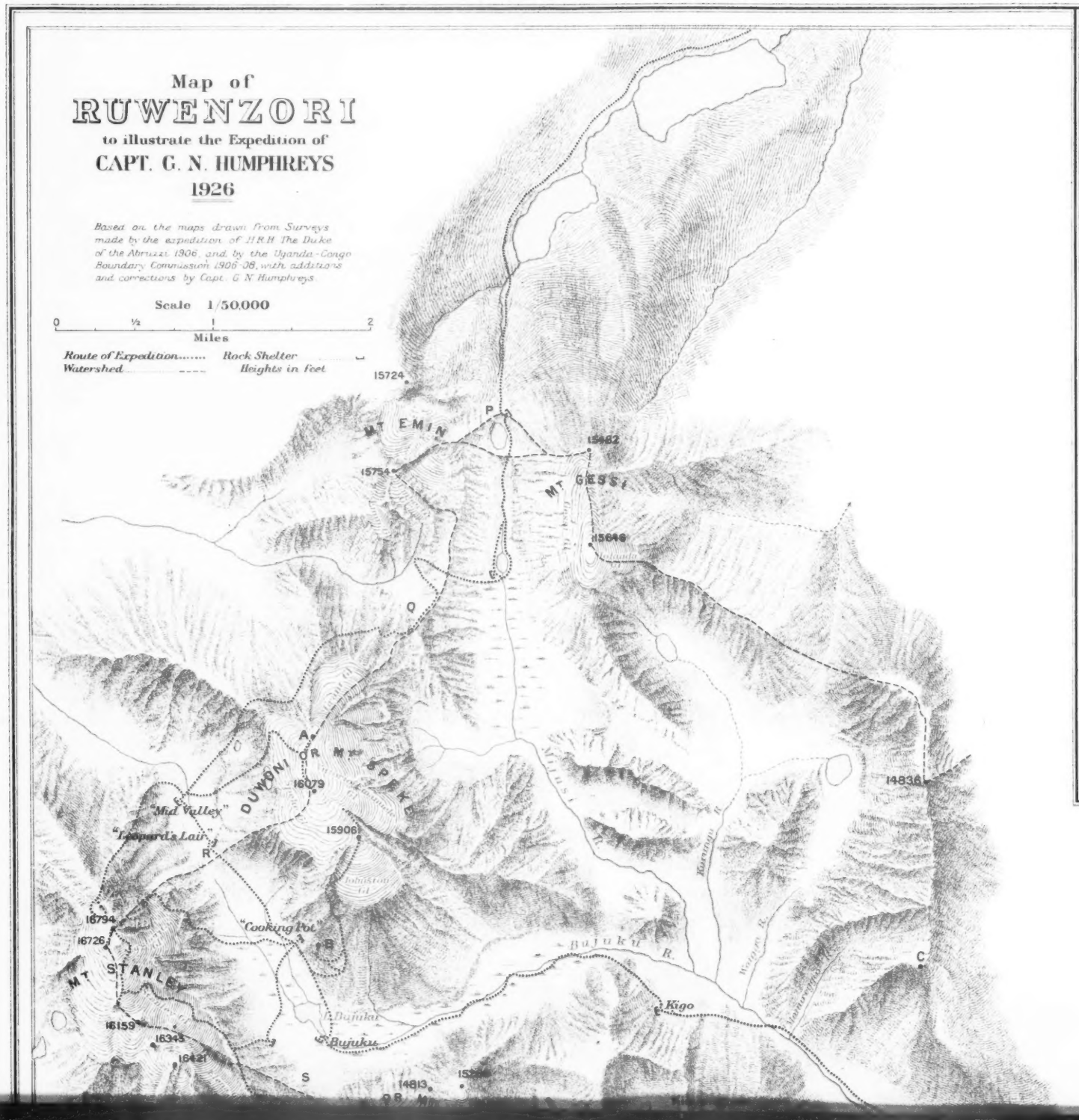
Twelfth Evening Meeting, 2 May 1927.—The President in the Chair.

ELECTIONS.—Mrs. Vera Jean Hamilton Antoniadi; The Ven. Archdeacon Francis Bertie Boyce; Lieut. Alan Vincent Gandar Dower; Miss Cecilia Phyllis Goodenough; Ernest Tooke Jameson, M.D.; Charles Matthew; The Rev. Euston John Nurse, M.A.; Humphrey Pease; Hugh Handley Pegg; Hjortur Chester Thordarson; Ph. C. Visser; Basil Patteson Walker-Taylor.

PAPER: Ladakh. Col. R. Meinertzhagen.

Seventh Afternoon Meeting, 9 May 1927.—Sir Charles Close, K.B.E. (Vice-President), in the Chair.

PAPER: The Stereoscopic Survey of the Shaksgam. Major K. Mason, M.C., R.E.


Map of
RUWENZORI
to illustrate the Expedition of
CAPT. G. N. HUMPHREYS
1926
Based on the maps drawn from Surveys made by the expedition of H.R.H. The Duke of the Abruzzi 1906, and by the Uganda-Congo Boundary Commission 1906-08, with additions and corrections by Capt. G. N. Humphreys.
Scale 1/50,000
0 ½ 1 2
Miles
Route of Expedition..... Rock Shelter
Watershed ---- Heights in feet
15724
MT EMIN
P
15482
15754
MT GESSI
15649
Q
A
DUWONI OR Mt SPEKE
16079
"Mid Valley"
"Leopard's Lair"
R
15906
16794
16726
"Cooking Pot"
A
B
MT STANLEY
16159
16343
16421
S
14813
Bujuku R.
Bujuku
Kigo
C
14836
Kamusi R.
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Mahoma R.
BELGIAN CONGO
30'
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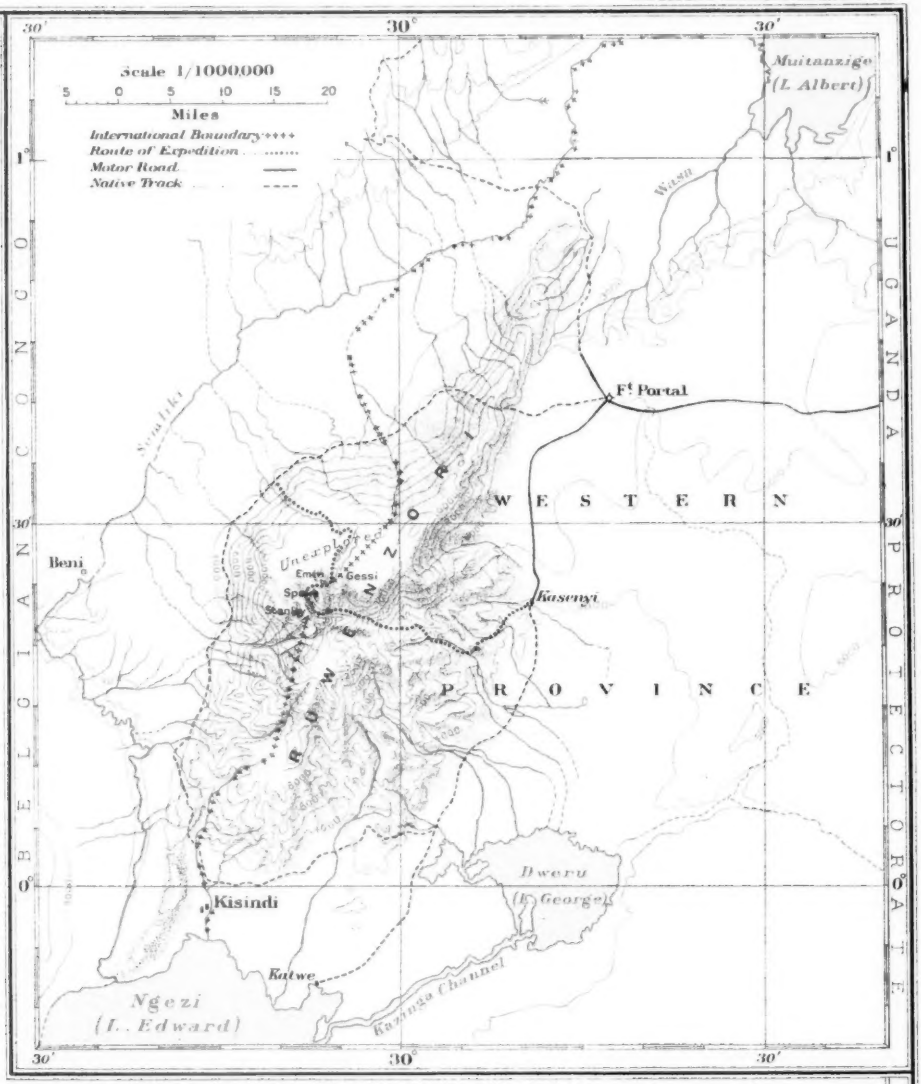
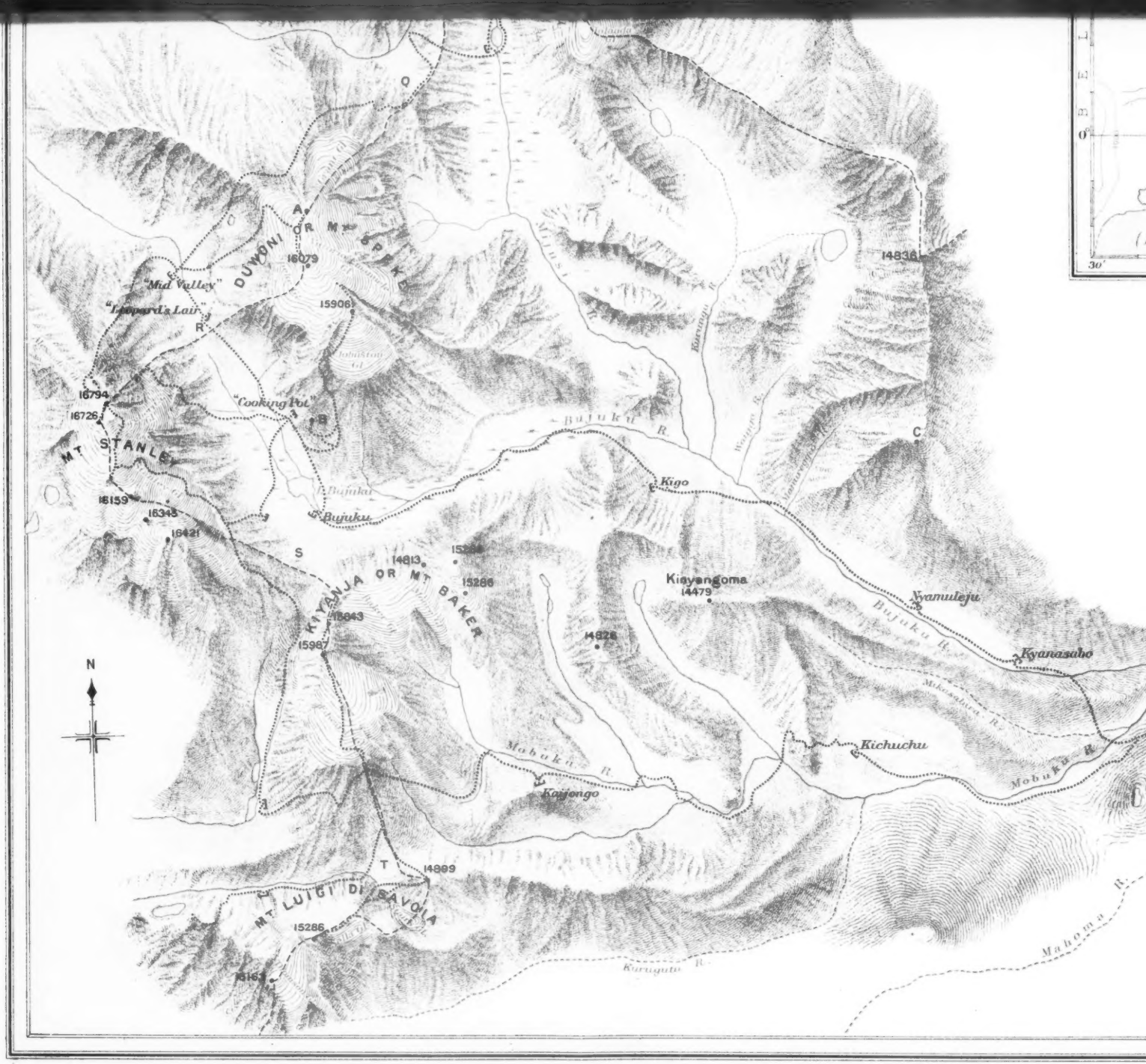
30'
Beni



Height	Mt. GESSI
15646	Iolanda Peak
15482	Bottego Peak
	Mt. EMIN
15754	Umberto Peak
15724	Kraepelin Peak
	DUWONI or Mt. SPEKE
A	Unnamed Peak
16079	Vittorio Emanuele Peak
15906	Johnston Peak
B	"Trident" Peak
	Mt. STANLEY
16794	Margherita Peak } Twin Peaks


DUWONI OR MT SPEKE
16079
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"Leopard's Lair"
"Cooking Pot"
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Bujuku
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Kigo
14836
Kiayangoma
14479
Nyamuleju
Bujuku R.
Kyanasabo
Mubuku R.
Kichuchu
Mubuku R.
Kazjongo
KIYANJA OR MT BAKER
14813
15286
15843
15987
14826
MT LUIGI DI SAVOIA
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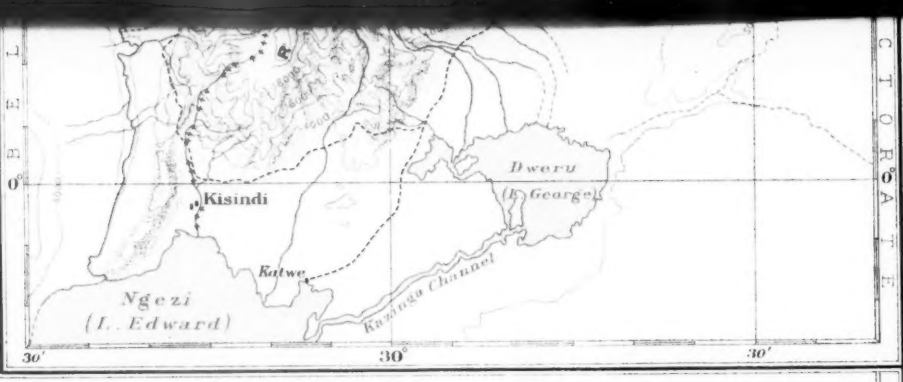
15183
Kurugutu R.
Mahoma R.
N
Published by the Royal Geographical Society



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16794	Margherita Peak } Twin Peaks
16726	Alexandra Peak } Twin Peaks
16421	Savoia Peak
16345	Elena Peak
16159	Moebius Peak
	KIYANJA OR MT. BAKER
15987	Edward Peak
15843	Semper Peak
15286	Wollaston Peak
15269	Moore Peak
14813	Grauer or King Edward Rock
	MT. LUIGI DI SAVOIA
15286	Sella Peak
15163	Weismann Peak
14899	Stairs Peak
14836	Nth. Portal Peak
C	Sth. Portal Peak
14826	Cagni Peak
14479	Kinyangoma
P	Roccati Pass (14,403 ft.)
Q	Cavalli Pass (14,141 ft.)
R	Stuhlmann Pass (13,757 ft.)
S	Scott Elliot Pass (14,262 ft.)
T	Freshfield Pass (14,403 ft.)

RUWENZORI
Humphreys

UNIV
OF
MICH

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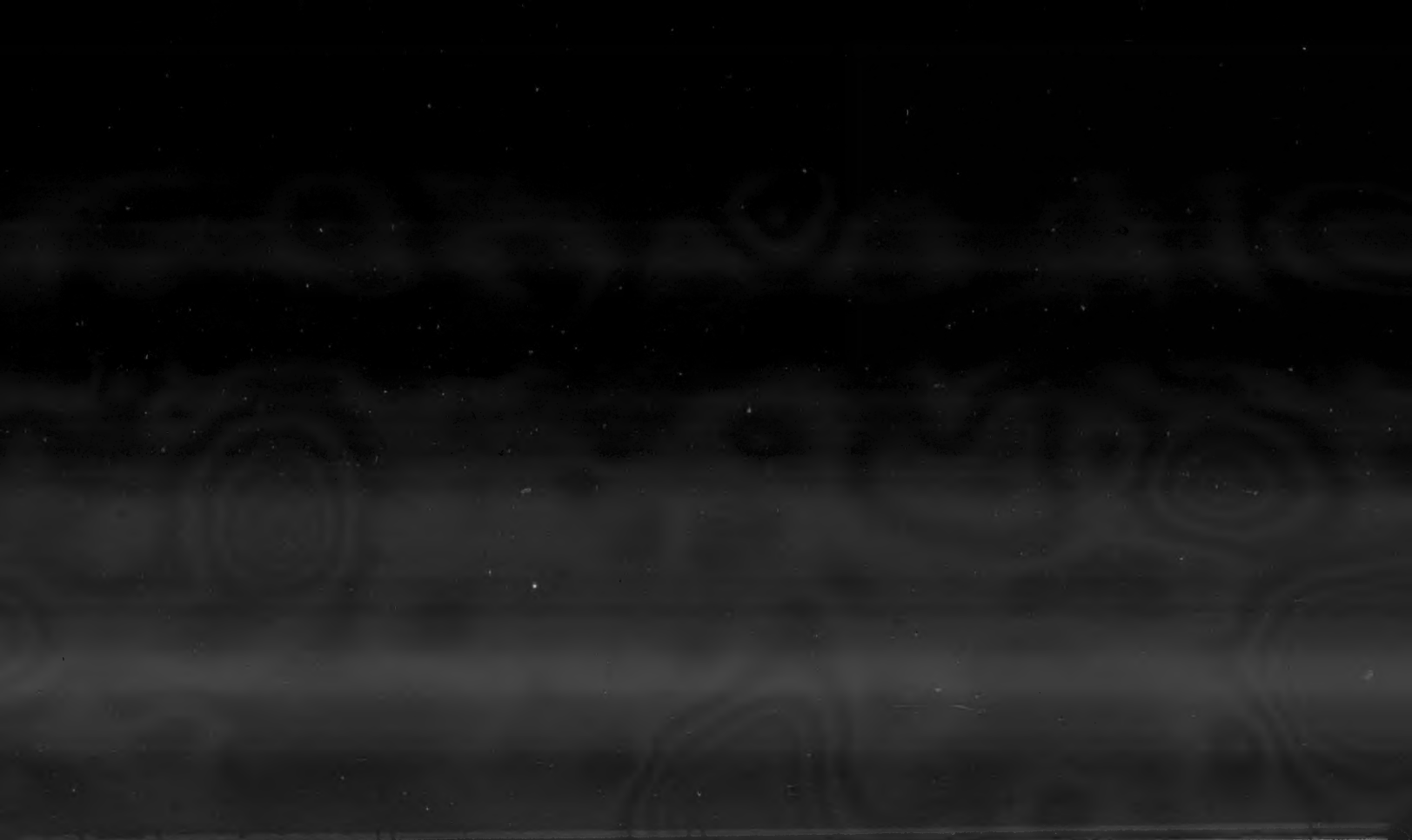

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